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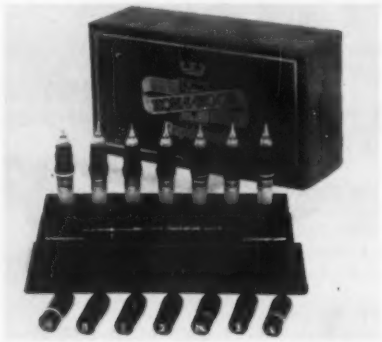

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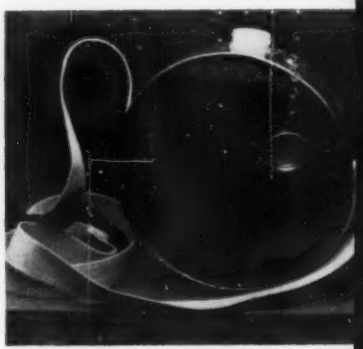

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Journal of Forestry

Official Organ of the Society of American Foresters

Overseas Forestry Students and Graduate School

J. V. Thirgood

American foresters, interested in academic training, the professional status of foresters, or simply curious about the image of American foresters abroad will find Mr. Thirgood's observations and comments thought-provoking.

BECAUSE of their situation in forest regions of particular consequence, graduate schools in western North America can make a significant contribution to forestry education by attracting men interested in the intimate study of the Northwest forest.

The graduate student from abroad will almost certainly have a different approach from his North American counterpart and will probably have different objectives. In this paper an attempt is made to give consideration to the particular approach of such students, the special characteristics of the educational background responsible for conditioning their thinking, and to suggest possible ways in which their objectives may be met through graduate study.

Although formulated from the viewpoint of the British student much of what is written is also applicable to men from other countries.

In general, discussion of comparative university standards is almost always colored by a tendency to favor the approach to which one was initially exposed. The question is specifically linked with general considerations of social, cultural, and educational traditions, and the level of pre-university education.

Not least, in regard to comparisons between Europe and North America, it reflects the different function of the university and the status of other forms of professional and vocational education. It is sufficient to note that graduation from universities in either North America or Britain indicates a certain broad level of intellectual capacity and ability to profit from formal study.

However, to understand the approach to the man from Britain it is desirable to recognize certain differences in the approach to forestry education at the university level in Britain and in North America, this without any implication of superiority of the one over the other, for they have different aims. Partially these differences have arisen from the different view of university education, but largely from a significant difference in the organization of the forestry profession in North America from that commonly found elsewhere, and as a consequence of this, differences in the function of the forester. Abroad, a graduate forester is trained to fit into the pattern of the professional district forest officer, forstmeister, inspecteur, or assistant conservator of forests, in sole charge of a territorial district varying from a few thousand acres to a whole province. He has a staff of vocationally trained foresters to assist him in the field and usually in direct charge of the day-to-day working of units. This organizational pattern is found both in intensive and extensively managed forests. A similar structure has not developed in North America. In place of individual units the basic administrative areas are larger and staffed by a team of specialists who work under greater or lesser direction, and a vocationally trained cadre has not been developed. Much of the technical work at the woods level which elsewhere would be deputed to the vocationally trained forester falls necessarily to the lot of the graduate, whose training must therefore fit him for such work. As a result of this difference the British or European forest officer on graduation, whether working at home or abroad, will almost certainly have a much higher degree of responsibility in his first appointment. Also, he has a commensurately higher professional status in relation to other fields of professional activity than his North American counterpart. He will have a very considerable measure of autonomy with little in the way of formu-

THE AUTHOR, when this article was prepared, was a graduate student, Oregon State College. He is now with the State University College of Forestry at Syracuse, N. Y.

He has been employed in British Columbia in state and industrial forestry; as FAO adviser on forest research, Iraq; as silviculturist, Cyprus Forest Service; and with the British Forestry Commission in research and practice.

lated prescriptions or instructions handed down. To all intents and purposes he will be in sole charge of all aspects of forestry within his district. In research he will work with a team of vocationally trained foresters and will be concerned rather with the planning and organization of investigations, and with the interpretation of results, than with the actual conduct of the often time-consuming and routine work of experiment layout, maintenance, and assessment at a number of very diverse sites. Thus, he can undertake a greater number of projects at any one time. He will usually be working in applied research. The more fundamental investigation will be the concern of the university scientist working in the basic disciplines, probably not a forester by training or experience. The success of such forest officers, whether in research or administration, will lie in their ability to interpret the basic principles and current and classical techniques, which they studied at a university, in the light of local conditions, and to build upon these in day-to-day management and long term planning. Rarely can they work by rote.

On the other hand it seems that the North American graduate in forest management most often finds himself initially working in a subordinate capacity, as part of a complex in which he is concerned only with a small section of the work and which he often does not see through to completion, be it public or industrial forestry. He may be in charge of a comparatively small field party, or engaged in routine technical activity, which elsewhere would be the direct concern of men trained at a vocational level and working under the general supervision of the professionally trained man. The case for a dual level of forestry organization and staffing has been thoroughly ventilated elsewhere. For example, by Francois in the authoritative FAO study "Forest Policy, Law, and Administration."

Implicit in this is the development of two discrete types of forestry education, (1) the vocational school of a definitely regional character which teaches techniques for direct field application, and (2) the professional school which concentrates on the basic principles of forestry, as a foundation on which the graduate may build by practical experience in the particular sphere in which he finds himself. The general principle is that each category of men requires a training designed specifically for that category and no other and that different personal qualities and orientation are required.

Lacking vocational schools, North American university schools of forestry appear to make up the deficiency by including a considerable amount of vocational training. This fits the graduate not only for the eventual role of forest administrator and/or scientist at the professional level, but equips him to undertake the work of the forest technician. Also, it has been, perhaps, necessary to open recruitment to include a proportion of those men capable of attaining technician status, who elsewhere would be candidates for subprofessional training, and for whom facilities are not yet available.

In the British scheme of things there is emphasis on full professional standing from the time of graduation. It is considered that this cannot be attained unless the graduate is employed in work comparable with other professions, with due regard to the different conditions of the forest.

In North America whereas the Bachelor degree, at least in more technical fields, seems to be often looked upon as but a stepping-stone to full professional qualification in the possession of the Master diploma, this is not so in Britain. There the first degree is considered as the culmination of a well-rounded training. Any further academic qualification is merely taken as evidence of further specialized training and will seldom be reflected in any financial benefits. Even in research, formal post-graduate qualification is likely to be held only by personnel working in the specialized ancillary fields. University lecturers very frequently have no advanced degrees. However, almost without exception they are men with long, and often distinguished, careers in the field, whose lectures are strongly interlarded with their own practical experience. This is a most valuable characteristic.

The B. Sc. degree course in forestry extends over three years, or four years if with Honours. The consensus of those who have been exposed to both American and British training is that the British school does not offer such a wide program of courses, and to all intents and purposes confines its attention to forest management in the broad sense, and to the sciences basic to that study. Courses are subject to a deeper and more detailed treatment, and the British student has to obtain a greater understanding of his subject. The forestry schools are small with a strictly limited intake and can be highly selective in their recruitment because of competition far available places.

While, so far as is known, no formal comparative study has been made of forestry education in the two countries, an evaluation of technical training, quoted by O. C. Carmichael, late president of the Carnegie Foundation for the Advancement of Teaching, in *Universities: Commonwealth and American* (Harper, New York, 1959) equated the British Higher National Certificates in technology with the first degree in the American university, or the standard reached in the British universities by the end of the second year. (It must be kept in mind in this regard that the usual European high school program encompasses at least the equivalent of the freshman year at the American college.) Some American observers have gone so far as to assert that the British B. Sc. should be equated with the American M.Sc. An essential difference, however, is that through the thesis requirement the M.Sc. gives some introduction to research. In Britain there is also awarded the B. Sc. (Honours). The significance of this degree, popularly known as an "honours degree" is perhaps not always understood in America. Depending upon the university, first, second,

third, or even fourth class honours may be awarded. These are granted on the basis of an additional year's study after the pass degree. Requirements are high. The honours degree is often looked upon as the first research degree.

It is unfortunately true that in the past the American M. F. has not had a very high rating in British eyes. It has been looked upon more as evidence that a man has had firsthand contact with American forest conditions, and as such a useful experience, than as evidence of a higher standard of attainment. It is only realistic to record that a large proportion of British students who have taken such addititional training have returned home disappointed. This may result in a few cases from an incorrect initial approach, and is much to be regretted. It has resulted also from the variable standing of the various forestry schools in the United States, which people in Britain do not always appreciate and cannot evaluate. Further, the often more advanced silvicultural knowledge and experience of the British student frequently allow him, if he takes the formal courses offered in his field of interest, to complete his year in North America with little additional work other than adjustment to the local conditions and terminology, and compliance with requirements for formal assignments and papers. This path, of course, leads to loss of interest. The overseas student is accustomed to a system of intensive and concentrated lectures and personal study in which a man on entry to a university and even in his freshman year, is considered mature enough to conduct his scholastic affairs unaided and in such a manner as to enable him to satisfy the final examiners. This student may be impatient of, and react adversely to, the doctrine of student participation, and the pattern of prescribed readings, quizzes and assignments, the daily busy work of the American student. He will probably consider these instructional methods to be superficial, inefficient, and unduly time-consuming. He may feel that if left to his own devices he could put to much better use much of the time which he is obliged to spend in classes and in directed studies. Prescribed references to specific pages and even to paragraphs he will consider as unconducive to wide reading. He may also be surprised at the emphasis placed on the study of individual papers in the periodicals and in the research notes and booklets that bulk so large in American forestry publication, rather than on the authoritative and classical texts of international standing, many of which are of course American. These he may find are often unfamiliar to his fellow students. Particularly will he contrast the piecemeal approach to testing and the use of objective methods, with their stress on facts, with the long essay type examinations to which he has been accustomed, where emphasis is on understanding and basic principles.

He is also likely to agree with Carmichael that: "Frequently there is a lack of discrimination between the facts and skills which can be learned later on the job and those which are basic to an understanding of principles which must be learned in the University."

In all this he may not be, of course, necessarily correct!

Usually an overseas graduate working for the M. F. will have one of the following aims:

1. He intends to settle in North America and feels the need for orientation.

2. He intends to settle and, interested in the more technical aspects of forestry, he finds the same weight is not given to the first degree as elsewhere, and the Master degree is necessary for advancement.

3. He intends to return to his homeland and wishes to obtain a knowledge of the North American forest and its silviculture.

4. He intends to specialize in a certain field for which particular facilities are available here.

Often, however, he may just wish to experience university life and see something of North American forestry before settling down to a career.

Most frequently his information of the nature of the academic world which he will enter will be very vague and will extend little beyond the Hollywood version of campus life. He will be quite unprepared for the extensive control exercised by the college over the student body in both academic and social affairs. Even the use of the designation "student" at the graduate level may surprise him. He will most certainly not be expecting to be returning to "school." In his studies the emphasis laid on formal course work in the graduate school and the wide range of courses that he may be expected to encompass may be unexpected, as will also be the possibility of introductory, or at least undergraduate work in the basic sciences at a time when he would expect his work to become more professionalized and his interests specialized. Accustomed to a relatively limited fixed curriculum he may be rather bewildered by the array of professional and cross-campus courses that are offered for his selection. In practically all cases his knowledge of the situation will contrast sharply with the local student fully familiar with the university system.

Because of the bonds of a common language, cultural heritage, and political philosophy, the British student is favorably placed, as compared to other overseas students, in regard to orientation. However there is perhaps a danger in these resemblances. It is deceptively easy to recognize the similarities and neglect the differences, Although we British may not always recognize the fact, we are Europeans and are motivated by an Old-World philosophy which is not that of the New World. It has been said with some truth that the British do not realize that they are Europeans until they leave Europe. It is not to be expected that the British student will react to a given situation in the same way as will his North American fellow student. There is also the question of language. George Bernard Shaw wrote, "The British and the Americans are one people divided by a common language." There is much truth in this aphorism. Especially in the field of scientific writing there are striking divergencies, and the British student is likely to ex-

perience very real difficulties in this regard if these differences are not recognized by his American professors. This is not merely a question of the use of colloquialisms, or of easily recognized differences in spelling. The more terse style that characterizes much of present day American publication —even to some extent, the style in which this paper is written—is foreign to the British graduate. He is accustomed to a syntax that to North American eyes may seem unnecessarily literary, verbose, and complex. Typically his sentence form is long and with supporting or amplifying phrases. If obliged to attempt an American style he will feel constricted. In his reading he may find North American research writing disjointed and disconcertingly lacking in continuity. It is very desirable that this difference be recognized for the difficulty will occur with each report that the student writes and which is critically examined. Comparison of American and British professional and scientific journals, such as the JOURNAL OF FORESTRY and the *Empire Forestry Review*, or the American *Science* and the British *Nature*, will indicate these differences. Although, quite obviously, the British student does not encounter the same language difficulties as the student whose mother tongue is not English, it is no exaggeration to say that where there is insistence on American forms, this can be one of the greatest single problems encountered by the British student during his academic life in a North American university.

Broadly speaking the average United Kingdom graduate in North America will look upon this period of training as an interlude, an extension of his experience, rather than the completion of professional qualifications, although he may, for career purposes, be eager to obtain the higher degree. If this rather different approach to graduate study is acceptable it is one which can have valuable results, but it requires a rather different orientation of study. Such a student will usually look for a general coverage of his chosen field rather than concentration on special and more limited aspects, with facilities for the extensive study of the main and over-all aspects of forestry in the Northwest. He will not expect to be exposed to a considerable amount of work in the basic sciences which he will consider were adequately treated during his first degree. His outlook will be strictly professional. In the pattern of university education at home if he had wished to become a botanist, or to work in one of the other basic fields, he would have taken his degree in that area and not in forestry.

An introductory or survey course, including climate, gross physical geography, forest types, policy, economics, and management, silvicultural and utilization practices in the region, would be most desirable, for few overseas students will have more than the most hazy knowledge of the region on arrival. The main courses could well be concerned with a more intensive but still broad treatment or amplification of those aspects which lie within the visitor's field of interest, rather than a narrow channeling into studies of special narrow sectors, unless these fall within a particular research interest.

In fields of a study with which he is already familiar it is probable that the overseas student will respond better to the more informal and flexible reading and conference course, where graduate courses are not available, than to undergraduate courses which can easily result in a considerable amount of repetition of ground already covered, although possibly from a different viewpoint. In many cases such informal work will better fit his needs and mental approaches even when formal graduate courses are available. However, he will always want to listen to an inspiring lecturer and may respond well to seminars.

Fields which could very well be followed with profit by European students outside the general area of silviculture, which will generally be their main concern, are the mensurational aspects of forestry, enumeration and survey methods, the use of digital computers, photogrammetry, and the general application of statistical concepts. The facilities available in these fields, and advances made, are perhaps not fully realized abroad. These have given as distinctive a stamp to forestry in North America, at this stage of development, as has the biological approach of Europe. The courses available might be of the greatest value to men who intend to work in tropical forestry, for many of the problems of the coast forests of the Pacific Northwest, particularly, have similarities to those of the wet tropics, and a study of local problems and solutions ought to be helpful in the development of techniques. To a considerable extent this is also true of the extraction and forest engineering processes of the region, and of protection. The methods of forest survey, the statistical concepts necessary under extensive conditions, exploitation methods; and in the protection field, studies in fire behavior, may be of interest. All have much in common with tropical development, as has the conversion of virgin forest to management, the approach to sustained yield, and the development of markets for less favored species.

In the drier parts of the West the forester who is interested in land-use problems and questions of multiple or integrated land use will find much to interest him. Courses in range management, erosion control and watershed management have much to offer, while the silviculture of the drier forest areas might be of considerable interest. The ponderosa pine forests of the Northwest for example have very great similarity to the coniferous forest regions of the Eastern Mediterranean, and much of the same problems are encountered.

Diploma in Forestry

The needs of many overseas students might perhaps be met better by the provision of some form of post-graduate diploma than through the media of the more intensive Master course which implies a more detailed consideration of the field selected. Although such a diploma might be an innovation it would recognize the special needs of overseas foresters and serve them well. A large number of men would wish to obtain an over-all impression of North Amer-

ican forestry and especially of the West Coast forest and of its species, without embarking on a research project or desiring the deeper academic study necessary for a higher degree. This type of specialized professional training at the graduate level is often provided in Britain through the provision of a post-graduate diploma course If such a course were to be made available in North American universities, and became known, it would surely meet with a very surprising response from Europe. It could be general in nature, broad in outline, and very desirably include an organized, though not necessarily conducted, tour of the Pacific Northwest forests and forest industries, and possibly some form of dissertation. It is not suggested the standards be lower than the existing graduate programs, for this would defeat its purpose, but that the general orientation and basis of the program be designed to meet the requirements of the foreign professionally qualified forester.

It would go far toward meeting the needs of the increasing number of experienced forest officers who come to spend some time in North America as recipients of various fellowships or at their government's expense, for whom attendance on a formal academic program is obligatory, but whose requirements are not well met through the existing Master program.

Doctorate Program

In concept the Ph.D. in North America differs in a number of respects from that of Britain. The British degree is awarded for a significant contribution to knowledge and requires detailed penetration of a limited area. The candidate is assumed to have attained a thorough understanding of his field prior to embarking on his Ph.D. study, and is a specialist in his chosen field. There are no formal courses and frequently considerable flexibility in residence requirements. The study may extend over a very considerable period of years. The degree is awarded entirely on the basis of the research contribution and is a mark of considerable achievement. While it may be obtained through continuing study after the honours degree it is not looked upon as an extension of formal education.

The British student confronted with American requirements may be impatient with the emphasis on formal course work as a basis for broad understanding in addition to the penetrating exploration of a narrow field that is implicit in the thesis study. This will be more acceptable to him if he feels that he is penetrating new ground, necessary for the development of his area of interest.

The American Ph.D. has also perhaps not received adequate recognition abroad, and with much less justification. It may imply a different kind of scholarship but one that is no less worthwhile. It is at least arguable that its attainment involves greater concentration of effort. Its requirements are almost certainly more onerous.

As the prime research degree it should maintain the character given it by the individual institution. There are no grounds for suggesting any difference in conditions of award for overseas and local men, provided there is recognition of previous attainment and an avoidance of repetitive courses merely to satisfy requirements for academic credits. In most North American institutions there is sufficient flexibility in the regulations to accommodate individual circumstances and a wide range of thesis subjects.

With the exception of the diploma course all the points discussed are presently available to the graduate student by judicious choice of courses. However, many students from overseas are slightly bewildered during the initial stages, by the apparently complex and formalized organization of study, especially in regard to the unfamiliar system of elective courses and the use of academic credits. The student may not realize the flexibility which is in fact often concealed behind a facade of formalism. In addition, perhaps he does not really know the courses that he should follow until too late for registration. Frequently, subsequent adjustments are necessary.

Difficulties may also arise out of requests by registrars for transcripts. These are not issued by many overseas universities and there is often considerable uncertainty as to what is required. The student may quite well be unaware of the grades that he obtained in his final degree examinations other than that he satisfied the examiners in the appropriate subjects. The fact of his obtaining his degree is considered as evidence of his attaining an adequate standard. For the rest, dependence is placed on his professor's personal reference and upon his subsequent experience and work history.

Individual professors, although they can help very considerably, cannot be expected to know the background and interests of a strange student at first sight. Two measures could mitigate this to a certain extent: (1) the overseas student could be advised to discuss the content of his proposed course with his own professor before leaving home, or possibly with someone who has been exposed to the American university system; and (2) the device of a special forestry counselor or adviser for overseas students could be provided. This faculty member might be similar to the tutor at a number of British universities, not necessarily concerned with specific fields of interest, or administrative matters, but with a special understanding of overseas student needs and difficulties, and if possible with some knowledge of their home background, or at least of forestry outside North America.

This paper had its genesis in discussions at two North American forestry schools, one Canadian and the other American. My thanks are due to the faculty members at the University of British Columbia and at Oregon State College who have borne with the possibly strange views of this overseas forester, and also to the various overseas students with whom I have discussed these matters. The views expressed remain, of course, my own.

An Examination of Seed Orchard Concepts[1]

Ray E. Goddard and
Claud L. Brown

DURING recent years, accompanying the tremendous upsurge of interest and research in forest genetics and related fields, seed orchards have been established on a relatively large scale, particularly in the Southeast. The parental trees used in these orchards are selected solely on the basis of their phenotypic expression of certain desirable characteristics. Most commonly, selected trees are chosen because they appear outstanding in several qualities and are termed "superior" or "plus."

Scions from selected trees are vegetatively propagated by grafting and placed in orchards for the production of seed. It is either expressed or implied that each clone in such an orchard will be progeny tested and clones which do not produce progeny of adequate quality will be removed from the orchard. The development of seed orchards and current information concerning their management have been thoroughly reviewed by Zobel et al. (8). This review as well as many other discussions of forest tree improvement tends to equate at least by implication the terms "seed orchard" and "clonal seed orchard."

The primary purpose of this paper is to point out that clonal seed orchards are not the only pathways leading to the mass production of genetically improved forest planting stock, and suggests the use of seedling progeny from controlled crosses as an alternate approach worthy of consideration. The authors are of the opinion that much of the early work in tree improvement in Europe, and in this country as well, has led the practicing forester, and even some engaged in tree improvement activities, to regard the progeny tested clonal seed orchard as the terminal product in forest tree improvement. Certainly the currently popular concept that the establishment of clonal orchards is the most logical procedure to use for the initial production of improved seed is questionable from both practical and theoretical standpoints, and is of sufficient importance to warrant critical evaluation.

THE AUTHORS are, respectively, assistant professor, School of Forestry, University of Florida, Gainesville, and silviculturist, Texas Forest Service, College Station.

[1]The authors wish to express their sincere appreciation to Dr. J. D. Smith, Department of Genetics, A & M College of Texas, for critically reviewing the manuscript.

Basic Considerations

In the establishment of orchards for the production of genetically improved forest tree seed, certain basic assumptions are made. It is assumed that the superior phenotypes selected are, on the average, genetically superior to the general population. It is further assumed that at least a portion of this genetic superiority is of the type that can be transmitted to the progeny of the selected trees. It is generally recognized that most economically important forest tree characteristics such as vigor, form, and wood properties are largely under the control of multiple genes. This is true for traits which vary in a quantitative rather than a qualitative manner. The simplest current-day concept is that multiple genes have either a plus or minus effect and are strictly additive. The more plus genes an individual plant possesses, the higher it rates for the characteristic in question. Strict additivity is lost to the extent that dominance and interaction between genes is present as well as by the degree of environmental influence on the characteristic in question. The additive portion of genetic variance is considered fixable in the sense that it can be transmitted to the next generation.

Genetic Gains from Clonal Seed Orchards

If a test planting of the progeny from a clonal seed orchard indicates above average quality and growth, it can be expected that extensive plantings under similar conditions will produce similar results. The degree of improvement to be expected is dependent upon the heritability times the selection differential. The selection differential i.e., the difference between selected individuals and the average of the population from which they came, may be very high, but the degree to which that difference is due to environmental factors or to dominance and epistatic effects cannot be expected to be transmitted to the progeny.

In establishing a clonal seed orchard it is desirable to maintain a high degree of initial selectivity among natural populations to include the best phenotypes currently available with the hope that better than average genotypes are also incorporated. But even if all were good genotypes, heritability perfect, and genetic effects strictly additive, it would be extremely unlikely that any of the selected parents contained the optimum in plus genes. Because of Mendelian segregation and recombination some individuals in the next generation will be poorer than the poorest of the parents and some will be better than the best of the parents. With perfect heritability the average of the progeny would equal the average of their selected parents. However, in the more realistic situation of incomplete heritability and not strictly additive effects, it must be

expected that the average of the progeny will revert toward the general population mean. The extent of the reversion is to a large extent dependent upon the degree of heritability of the characteristics on which selection was based. Because the heritabilities of economically important forest tree characteristics are not known, it is perhaps fruitless to predict selection progress on the basis of formulae which must depend, for any degree of reliability, upon accurate estimates of heritability. If the selection differential is high, as it is in most selection programs, and if there is some degree of heritability, the progeny of a clonal seed orchard will be an improvement over the present sources of seedlings for reforestation.

The clonal seed orchard is, however, only one step forward. It would be presumptuous, indeed, to assume that it offers greater genetic gains than those obtainable by the use of selected seedling progeny resulting from controlled crosses among the original plus tree selections. For example, if the original parental selections (i.e., plus trees in natural stands) are crossed among themselves, using a pollen-mix from all selected trees, and only the phenotypically best progeny are considered, their average value should be above the general population mean. These selected progenies would therefore be the trees used for seed production. If this first selection among the first generation progeny is effective, the average of the second progeny generation would be at least as far from, or further from, the general population mean than would the progeny of a clonal seed orchard from the same original selections. The second progeny generation would he the trees used for commercial planting.

Development of Seed Orchards from Seedlings

On the basis of the foregoing reasoning the tree improvement program of the Texas Forest Service in the spring of 1959 inaugurated a program of controlled breeding to (1) produce seedlings for immediate seed orchard establishment, and (2) initiate the first cycle of a method of breeding adaptable to wind-pollinated, heterozygous pine species. As in other programs, trees have been selected on the basis of desirable phenotypic characteristics. Pollen was collected from the selected trees, appropriately mixed, and used to pollinate each of the individual mother trees. Thus, although both parents of all resulting progeny were selected, only the exact female parent will be known. Seedlings resulting from these controlled pollinations will be used to establish progeny tests. Although all parents were selected, it is only too obvious that where selection is based on multigene characteristics of incomplete heritability, some individuals are mistakenly selected because the effects of environmental variation make them appear phenotypically better than their genetic values. Therefore, it is extremely likely that some of the parents should not have been included at all, and on the basis of first generation progeny performance, i.e., test for general combining ability, entire mother tree lines that are inferior may be eliminated. In addition, poorer phenotypes of the better lines may also be eliminated.

Because the progeny obtained by the polycross method described above are to be used initially as a progeny test and subsequently as a seedling seed orchard it must have several special criteria. First of all it should have close initial spacing, possibly 6×6 feet in southern pine, to permit the removal of approximately 90 percent of the population at the first thinning. Secondly, and of prime importance, is the experimental design used in establishing the progeny test seedling orchard. Complete seedling randomization would be desirable to avoid groups or rows of "saved" trees with large openings around them, after the first thinning; however, this type design limits to some degree the treatment of progeny test data, and at the same time entails considerable record keeping difficulties. In view of the fact that a large number of plus tree selections are to be used initially in the breeding program, and later selection of individual seedlings will be made within as well as between mother tree lines, it seems practical and feasible to adopt some form of randomized block design using a small number of seedlings from each progeny group or mother tree line as the basis of the individual blocks. The tests could be replicated any number of times, depending upon the final acreage desired in seedling orchards.

The removal of inferior lines and of inferior phenotypes within the better lines must be delayed until valid selections can be made. However, to avoid increased difficulty in seed collection, and to allow development of adequate crown for abundant seed production, the thinning should be made while the trees are relatively young. It is expected that inherent tendencies for desirable limb and bole characteristics as well as good growth rate will be expressed at an early age. Correlation of wood density between juvenile and mature wood (7) indicates that fairly reliable selections for this property may be made before adequate mature wood is formed. Also adequate criteria are now available for making valid drought hardy selections in one- and two-year-old loblolly pine seedlings under artificially induced drought conditions. While the reliability of selection in young trees would no doubt be less than the reliability at a more advanced age, there is little doubt that the average genetic value of those remaining would be higher than that of those removed.

As a result of this thinning only approximately 10 percent of the trees originally planted in the progeny test will be saved. These will be managed for seed production in a similar manner to a clonal seed orchard. Although the selection differential will not be as high as in the original selections, the differential should be sufficient to offset any tendency for retrogression to the general population mean. It is obvious that this first progeny selection is primarily designed to eliminate entire lines of mother trees which show poor heritability from any cause and as such it is a method of testing the gen-

eral combining ability of individual mother trees using mixed pollen from all other selected plus trees. From the standpoint of practical seed orchard management, and from over-all genetic gains as well, one is concerned with general and not specific combining ability of trees represented. It should be mentioned at this point that one must use considerable discretion in selection within the better mother tree lines so that approximately equal numbers of progeny will result in each line to avoid a buildup of closely related progeny in successive generations due to an increase in sibbing (brother-sister mating). Similar caution should be exercised in eliminating entire mother tree lines. Even though it may be possible in later generations to increase homozygosity in certain lines advantageously, our present meager knowledge of heritability in southern pines indicates that a considerable degree of heterozygosity is present and desirable and that a substantial amount of improvement can be initially obtained by taking advantage of this heterozygosity.

Another important point which must be considered is the number of original phenotypic selections needed to carry on a program of this sort. Stern (*5*) has recently calculated the rate of inbreeding in progenies of seed orchards using various numbers of clones, and concludes that in the case of continued selection of N clones through several generations, 40-50 clones will be sufficient to avoid inbreeding effects. The same principles apply equally well to the number of mother trees needed to begin a program of breeding and selection. If one hopes to make the most rapid gain possible from the very beginning then the poorer genotypes (mother tree lines) would have to be eliminated by the first generation progeny test. Therefore, any number less than 40 would be considered inadequate and 50-60 original tree selections would be more desirable. This problem is not quite as serious in grafted seed orchards if the progeny from the selected clones are considered the end product in tree improvement. If, however, additional gains are to be made through breeding and selection, the number of original parents comprising the clonal orchard also becomes a matter of primary concern.

In establishing a seed orchard using controlled pollinated seedlings it will be necessary, first of all to obtain enough seed from each mother tree to allow competent progeny testing. In some cases this could require 2 to 3 seasons of repeated pollination with the result that 3 to 5 years may elapse before the initial establishment of sizable acreages of seedlings. Nevertheless, the time element is shared in common in establishing comparable acreages of clonal orchards due to failure in initial grafting success and mortality in subsequent years resulting from scion-stock incompatibility or other causes.

Seed Production Potentials

In addition to consideration of genetic gains from clonal seed orchards and seedling orchards from selected parents, comparison of seed production potential must also be made. Perhaps one of the primary reasons for the trend in establishing only clonal orchards in this country (other than that of improving the genetic quality of seed) lies in the success obtained by European workers with species such as *Pinus sylvestris* L., and *Larix decidua* Mill. in securing early and abundant cone production from grafted stock. Whether or not grafted clones will be as useful and successful in southern pine species is open to question. The cone production of loblolly pine grafts in seed orchards near Alto. Texas, and Many, Louisiana, has been below earlier expectations. Only 38 percent of all grafts entering their sixth year produced one or more female flowers with an average of 3.9 flowers per graft. Out of the 10 clones of this age represented, four clones produced 96 percent of all female flowers and only one clone produced any pollen. The grafts now average 12.2 feet in height and appear exceedingly vigorous. It seems apparent that the flowering response will increase but even now occasional 6-year-old loblolly pine seedlings growing in plots adjacent to the 6-year-old grafts are more prolific in their production of female strobili. Ten or more years from now it is reasonable to expect cone production of seedling plants to equal that of grafts of the same age provided the seedlings are initially grown at wide spacing and given cultural treatments such as cultivation and fertilization. In fact, from current direct comparisons of strobili production of grafts and seedlings of loblolly pine, there is no valid basis for assuming 15-year-old grafts would out-produce the same age trees under comparable conditions of seed orchard management.

Cost Considerations

Another consideration is the comparative cost of the two types of seed orchards. Both controlled pollinations and grafting are expensive. Preliminary cost studies in the Texas program indicate that successful grafts are, on the average, 40 times as expensive as seedlings produced by controlled crosses. These differences would be even greater if pollinations were performed on a relatively large scale. In addition, the use of bulked pollen from selected trees considerably reduces costly recording during pollinations. This was another reason for the choice of this type of progeny in the Texas program.

Regardless, however, of comparative costs of grafts and seedlings from controlled pollinations, the clonal orchard, as pointed out by Wright (*6*), must also be progeny tested. Many workers expect to use controlled pollinated seedlings to establish progeny tests (for example Barber [*1*]). Therefore, the cost of a clonal seed orchard plus a progeny test must be compared with a progeny test alone. It is true that the controlled pollinations for progeny testing clonal seed orchards will largely be done in the seed orchard and that the controlled pollinations for establishment of seedling orchards will be done on the original selected trees, a somewhat more expensive procedure. However, with a yield

of 20 to 150 cones per tree in contrast to 2 to 15 per graft, the difference in pollination costs is not as great as might be thought.

Discussion

From the foregoing discussion one may conclude that grafted or clonal seed orchards offer no special advantage over seedling orchards either in ease of establishment, economic considerations, or the length of time involved in producing improved seed in commercial quantities. Certainly from the standpoint of genetic gains there can be no serious objection to the use of the latter. On the contrary, a seedling orchard of the type described here provides one with a wealth of valuable germ plasm from which to develop second, third, or fourth generation seedling orchards by adopting a recurrent selection program where the pollen from the best progeny in each generation is bulked and applied to individual mother trees with outstanding characteristics. At any time along the way the most elite individuals could be selected for making specific crosses and for establishing clonal orchards if desired, or the system of reciprocal recurrent selection as described by Comstock et al. (*2*) could be modified and used advantageously in testing for both general and specific combining ability.

One should again be reminded of the fact that having once established clonal orchards from the best available trees, no possibility remains for further improvement unless some type of a controlled-pollination program is instigated. Thus, the establishment of clonal seed orchards indeed appears to be an expensive stop-gap measure. The primary phase of a recurrent selection program as initiated in the Texas program should produce comparable seedlings immediately, and, since subsequent selection is based upon combining ability after the initial selections, it also presumes that additional gains can be obtained in future generations.

Some may object to the use of bulked pollen in the breeding method advocated here. In fact, the suggestion has been made that the mixing of 10 pollens into a single batch is questionable because of the possibility that one male, if extremely potent, might do all the pollinating. The absurdity of such reasoning is obvious if one reflects for a moment upon the possibilities of chance involved in random pollination. Even if it were mechanically and physically possible to obtain complete randomization of 40 to 50 pollens in the micropyle of each ovule on each ovuliferous scale of every pollinated strobili, too many probabilities still remain to warrant serious consideration of preferential fertilization by a few phenotypes. There is the possibility, of course, that partial sterility barriers could exist between different plants due to differential rates of pollen tube extension in maternal tissues. In most cases, however, incompatibility of a comparable nature is due to a series of multiple alleles, such that the pollen containing a specific allele will not function in maternal tissue containing the same allele (*3*). If a similar mechanism exists in southern pine, it poses no serious problem to obtaining random fertilization because only a portion of the segregating male gametes would contain the sterility allele and be nonfunctional. A population cannot exist with only two such alleles, and, regardless of the frequencies in the initial selections, an equilibrium will be approached within a few generations such that all alleles will have similar frequencies (*4*). In fact, if a self-sterility system of this type did exist it would be a definite advantage to any recurrent selection program, because it would tend to reduce the inbreeding coefficient of the composite population during the early generations of selection.

The possibility of not obtaining random pollination in the seedling orchard because of differences in flowering time between individual trees surely exists. Nevertheless, the occasional loss of pollen from a few of the heterozygotes present is certainly less serious than a similar situation in a clonal orchard, e.g., the failure of an entire clone or clones to be in rhythm with neighboring or adjacent clones.

Although some may strongly object to the selection of individual trees for exceptional growth rates or vigor as early as the fifth or tenth year, there is, of course, a limit imposed as to the length of time one can progeny test plantations before a decision is made in this respect. In actual practice it is extremely doubtful that the largest and most vigorous seedlings in a plantation at the end of five years would be the ones to become suppressed at a later time by the initially slow starters, although it is recognized that there is some degree of shifting in crown position among individual trees for many years. The utility of juvenile selection criteria can be enhanced by making parent-progeny regression analyses on heritability in addition to the usual components of variance type heritability analyses on the first generation progenies. If the performance of any progeny in youth is demonstratively similar to its parent at or near maturity, the chances of realistic interpretation of juvenile characteristics are materially strengthened.

Summary

It is concluded that seedling orchards offer several distinct advantages over clonal orchards which should enhance their utility in the future. Many of the difficulties encountered in the establishment phase of clonal orchards, such as those centering around initial graft success and the subsequent loss of older grafts, can be circumvented entirely by the use of selected seedling progeny, and at considerable less expense. It is recognized, however, that the only really valid argument for the preference of either type orchard, lies not in cost comparisons per se, but in which method of mass seed production leads to the greatest genetic gains. The answer seems obvious. A clonal orchard, once progeny tested for general combining ability and accordingly rogued, stands as an entity on its own merits. Its sole function is the quantity production of improved seed, and as such, the amount of genetic gain obtained by this approach is fixed. The most

plausible means of achieving additional and continued gains is through breeding and selection. This being the case, the time consuming stop-gap measure of establishing clonal orchards may as well be by-passed and a program of controlled breeding adopted at the beginning. In such a program, only token grafting would be done to establish small breeding plots which are considered essential for preserving the original selections and for later use in breeding.

Once a seedling orchard is established from the first generation progeny of selected trees a wealth of valuable germ plasm is readily available from which to start a second cycle of improvement by utilizing selected progeny from progeny tested parents. As previously pointed out, if heritability is high enough to obtain any degree of genetic gain, then surely the greatest gains in the shortest possible time will be made by following some method of breeding, such as a modified system of recurrent selection. Tree improvement would be the primary goal under such a program and seed production a secondary function obtained from progeny test seedlings occupying any desired acreage. Consequently, seed production would be adequate, practical, and relatively inexpensive. Based upon these considerations, the authors maintain that the establishment of clonal lines from untested phenotypic selections in wind-pollinated, heterozygous coniferous species, is difficult to justify as the most logical approach to use for the initial production of improved seed.

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Rockefeller Awards Go to U. S. Careerists

Dr. Richard E. McArdle, chief of the U. S. Forest Service, and Conrad L. Wirth, director, National Park Service, were among six outstanding career civil servants selected to receive the 1960-1961 Rockefeller Public Service awards.

One of the highest forms of recognition given for distinguished service to career federal employees, these $3,500 awards are made possible by a fund established by John D. Rockefeller III and administered as a national trust by the Woodrow Wilson School of Public and International Affairs at Princeton University.

Dr. Robert F. Goheen, president of Princeton, will make the awards in Washington this month.

Woodland Management by Single-Tree Selection: A Case History

Leon S. Minckler, William T. Plass, and Russell A. Ryker

NINE YEARS of experience have shown that the single-tree-selection method using a 3-year cutting cycle cannot be sustained indefinitely in a stand of uneven-aged timber in southern Illinois. Why? Because in the initial 9-year period the cuts have removed nearly all of the economically mature trees, and the individual-tree-selection system of cutting has not favored the establishment of desirable reproduction.

At the Kaskaskia Experimental Forest we made cuts on a 23.7-acre wooded tract for 9 consecutive years. The purpose was to determine whether an acceptable minimum cut could be sustained annually on the 24 acres and what costs and returns could be reasonably expected.

The tract is typical in many respects of the "farm woods" found in the Central States. It is isolated by land used for crops. The topography includes coves, slopes, and ridges. Site quality varies from good to fair for native hardwoods. The general timber type is oak-hickory, with oaks (*Quercus*) and hickory (*Carya*) predominant, and a few yellow-poplar (*Liriodendron tulipifera* L.), white ash (*Fraxinus americana* L.), and black walnut (*Juglans nigra* L.) trees on the better sites. When the study began in 1949, the stand was uneven-aged and there was a wide range in tree diameters and several over-mature trees per acre (Fig. 1). The stand had not been managed previously, but there was no evidence of cutting, grazing, or fire more recent than 20 years ago. Although, like most unmanaged forests, the stand contained many cull and undesirable trees, stocking was better than average for Illinois woodlands (Fig. 2).

THE AUTHORS are research foresters, Central States Forest Expt. Sta., U. S. Forest Service, Carbondale Research Center, Carbondale, Ill. (maintained in cooperation with Southern Illinois University).

The stand was growing 150 to 175 board feet per acre each year, but we believed that under management growth could be increased to exceed 200 board feet per acre. So we set an allowable annual cut for the whole area of 200 board feet per acre with the expectation that this would not deplete the stand and probably would result in a small growth surplus.

How We Managed the Stand

We divided the tract into three 8-acre blocks and made selective cuttings in one block each year (Fig. 3). After 9 years each block had been cut three times. All trees in the stand 4.6 inches d.b.h. and larger were inventoried and the trees to be cut or killed were marked. The original stand on the 24 acres contained 96,720 board feet gross volume (International 1/4-inch rule) in merchantable trees. In the 9-year period we cut 42,295 board feet of merchantable sawtimber, or about 44 percent of

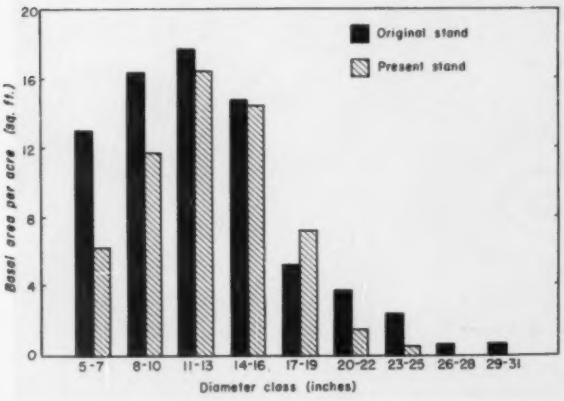

FIG. 1.—Good farmwoods; diameter distribution per acre of original and present stands. Live non-cull trees.

FIG. 2.—View of stand before cutting. The stand was reasonably well-stocked but contained many culls and low-quality merchantable trees. In the foreground trees marked with a bar were subsequently cut and those marked with a dot were killed.

FIG. 3.—These logs and white oak stave bolts are one year's cut from 8 acres.

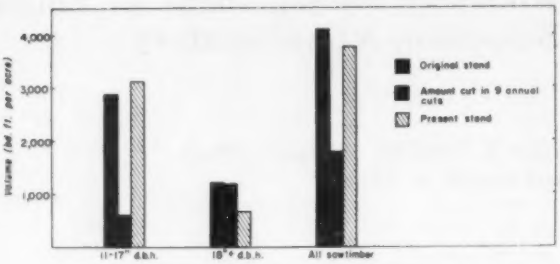

FIG. 4.—Small farmwoods sawtimber volume per acre.

the original volume. After the 9 annual cuts the stand contained 89,010 board feet gross volume. Besides the timber harvested, an additional 61 pole-sized and 5 sawtimber-sized trees per acre were killed. Of these all the sawtimber and about 1/3 of the pole-sized trees were culls. The rest of the pole-sized trees would have made mine props, but there were no prop markets. These were killed because they were not potential sawtimber trees.

The 42,295 board feet of tree volume scaled 39,393 board feet gross log scale. The log cull was 8.5 percent. The percentages of volume by log grades (Forest Products Laboratory) were as follows:

	Percent of total volume
Cabinet veneer	3
Factory grade 1	22
Factory grade 2	24
Factory grade 3 and structural	30
Local use	21
	100

Results After 9 Annual Cuts

Stand volume growth.—Despite the fact that an average volume of 1,800 board feet per acre was removed from each block in 3 cuts, the average stand volume has only been reduced 325 board feet per acre (Fig. 4). The net sawtimber growth, after the cuts and improvement treatments, averaged 209 board feet per acre per year. Although there were 9 cuts, the growth periods from first to last inventory were 8, 7, and 6 years, respectively, for the 3 parts of the woodland. When all blocks of the woodland have had 9 years of growth, and assuming the average growth rate of 209 board feet per acre annually, the total stand on 24 acres would contain 99,000 board feet. This would be about 90 board feet per acre more than the original stand.

Changes in stand structure.—Cutting and girdling during the 9 years reduced the basal area of trees in both the smallest and the largest diameter classes (Fig. 1). Virtually all trees larger than 22 inches d.b.h. were eliminated and the number of pole-sized trees was reduced by more than half. This was the result of girdling many pole-sized culls and because many poles grew into the sawtimber class. The basal area of trees in the 11 to 16-inch class remained nearly the same while the number in the 17 to 19-inch class increased significantly.

The present stand contains only 227 board feet per acre in trees 20 inches d.b.h. and larger. This amounts to less than one tree per acre (Table 1). Only about 5 trees per acre are 17 inches or larger. However, the small sawtimber trees, 11 to 16 inches d.b.h., are well represented and the pole sizes are probably adequate in number for a balanced stand. The current diameter distribution has resulted from the single-tree-selection cutting of the mature and overmature trees during the 9-year period. Although the stand is in good condition for growth, ***harvestable trees are scarce*** (Fig. 5). Further cutting now would necessarily reduce

FIG. 5.—View of stand after 3 cuts of 600 board feet per acre at 3-year intervals. In addition many cull trees have been killed. Few large trees remain and no large holes in the stand have been made by the cuttings.

Table 1.—Stocking Structure Per Acre of the Farm Woodland Stand After 9 Years of Annual Cuts

Diameter group (inches)	Trees	Basal area	Volume
	Number	*Square feet*	*Board feet*
5-7	32	6.1	------
8-10	26	11.7	------
11-13	21	16.4	1,348
14-16	12	14.4	1,419
17-19	4.1	7.1	758
20-22	.7	1.4	178
23-25	.1	.4	49
Totals	95.9	57.5[1]	3,752

[1]Plus 1.4 square feet basal area of live cull trees per acre.

Table 2.—Reproduction Present on Farm Woodland After 9 Years of Annual Cuts (Number of stems per acre)[1]

Species	Seedlings[2]	Saplings[3]		Total
		Less than 2" d.b.h.	2" d.b.h. and larger	
Hickory	1,000	100	100	1,200
White oak	700	[4]	100	800
Black and red oaks	800	[4]	[4]	800
Yellow-poplar and black walnut	200	[4]	[4]	200
Miscellaneous species	3,200	1,000	100	4,300
Nontimber species	1,400	300	T	1,700
Totals	7,300	1,400	300	9,000

[1]Expressed to nearest hundred. T means trace.
[2]At least 4.5 ft. tall but less than 4.6 in. d.b.h.
[3]Less than 4.5 ft. in height.
[4]Less than 50.

the number of good growing stock trees smaller than 20 inches d.b.h.

Changes in species composition.—The reduction of basal area resulting from the 9 cutting treatments was mostly at the expense of hickory, the black and red oaks (*Quercus velutina* Lam., *Q. borealis* Michx. F., *Q. coccinea* Muenchh., *Q. falcata* Michx.), and several less important species. After the cutting and killing treatments, the number of hickory and miscellaneous undesirable trees was reduced by about half and black and red oaks by about one-fourth. There are now proportionately more white oak (*Quercus alba* L.), yellow-poplar, and black walnut than originally. Thus the cutting of mature and low-quality trees and girdling treatments to eliminate culls have improved species composition of the overstory stand.

Reproduction.—After 9 consecutive light cuts on the 24-acre area (using a 3-year cutting cycle) there were 9,000 seedlings and saplings per acre but only 20 percent of the stems were desirable species (Table 2). Experience has shown that the desirable species will not form a significant portion of the future stand *unless openings are made to admit light through the canopy.* Some release from overtopping "brush" is also necessary in certain areas. Only 100 to 200 stems per acre of the oaks, yellow-poplar, and walnut were of sapling size. All the others were seedlings less than 4.5 feet in height. It is apparent that the 3 selective cuts spaced 3 years apart have not resulted in vigorous development of desirable reproduction.

Costs and returns.—In considering this study from a financial viewpoint, an estimated stumpage value (plus girdling cost) of $26 per thousand board feet was used. This figure was arrived at by subtracting the average total production cost of lumber for 10 operations in southern Illinois ($50 per thousand feet) from the current market value of the products that the cut timber could have yielded ($76 per thousand board feet net log scale [Table 3]). Our actual logging cost on the 24 acres was $19 per thousand and girdling of culls cost $3.59 per thousand of logs delivered to the side of the road (Table 4).

A return of $26 per thousand would have given the forest landowner about $937 over the 9-year period for the 36,045 board feet net of logs. A total of $142 was spent for girdling culls which leaves $795 stumpage for the 9 annual cuts on the 24 acres. This much was earned and the stand is in much better condition than at the start. By doing some or all of the girdling and logging work himself, or with his family, the landowner could have earned additional wages.

Fixed costs including taxes and interest on investment are not included here because farm owners would generally pay these costs whether or not they practiced good forestry. Such costs would be proper charges against an operation concerned primarily with timber growing.

Appraisal of Success of the Management Practices

How shall we appraise the success of single-tree-selective cutting of 600 board feet per acre on a 3-year cutting cycle? What has been accomplished and what are the pitfalls that should be guarded against? Is there a better way to place a small woodland under good forest management? These questions are discussed in the following sections.

Stand rehabilitation.—The rehabilitation operation provided an annual "job in the woods" for the owner. This provided a continuity of work and interest in forestry considered desirable by some extension foresters. Nearly 5,000 board feet of logs were produced each year for use on the farm or for sale. The cull trees and lower quality merchantable trees were eliminated and the species composition of the stand was improved. Aside from all this, however, the annual cut on the 24-acre tract had several disadvantages as a means of stand rehabilitation. It prolonged the job over a long period so that the full benefit of the treatment was greatly postponed. Maximum net growth and the best conditions for reproduction were sacrificed.

The costs and returns balance for the 9 rehabilitation cuts was satisfactory. Cuts per acre were operable and practical but heavier cuts would probably have resulted in somewhat lower production costs per thousand board feet. On a small woodland, the greatest economic

TABLE 3.—LUMBER VALUE OF LOGS CUT FROM 24-ACRE WOODLAND DURING 9-YEAR PERIOD

Log quality	Net log volume	Weighted value of potential lumber[1] per thousand board feet	Total value of lumber by log grades
	Board feet	*Dollars*	*Dollars*
Veneer	1,225	150	183.75
Grade 1	7,750	104	806.00
Grade 2	8,723	77	671.67
Grade 3 and structural	10,777	64	689.73
Local use	7,570	50	378.50
Totals	36,045		2,729.65
Mean lumber value of logs per M gross scale (39,394)			$69
Mean lumber value of logs per M net scale (36,045)			76

[1]Based on average lumber grade recovery for red oaks by log grades (Forest Products Laboratory Report No. D1737) and average lumber prices quoted in September 1954 for plain sawn, air-dried 4/4", red oak lumber. Lumber value of local-use logs was estimated.

TABLE 4.—PRODUCTION OF LOGS TO SIDE OF ROAD: COST PER THOUSAND BOARD FEET GROSS LOG SCALE

Operation	Crew used: Men	Crew used: Equipment	Crew hours: Men	Crew hours: Equipment	Hourly rate: Crew	Hourly rate: Equipment	Total cost
			Hours		*Dollars*		*Dollars*
Marking	1	paint gun	0.45	0.45	2.44	0.30	1.23
Felling and bucking	2	chain saw	2.11	.50	2.48	1.00	6.19[1]
Scaling and grading	2	.....	1.21	.....	3.13	.....	3.84[2]
Skidding	3	D-4 tractor	1.00	.55	3.87	6.25	7.83[3]
						Total	19.09

[1]Includes $0.45 for supervision and miscellaneous.
[2]Includes $0.05 for miscellaneous.
[3]Includes $0.52 for supervision and miscellaneous.

GIRDLING CULL TREES
Cost per thousand board feet gross log scale cut

Marking	1	paint gun	.45	.45	2.44	.30	1.23
Girdling	1	ax	1.97	1.97	1.15	.05	2.36
						Total	3.59
Total direct costs per thousand board feet							22.68

disadvantage of light frequent cuts is the lack of appeal of small lots of stumpage to operators. Many would not be interested in the 4,500 to 5,000 board feet cut per year on the 24-acre woodland. A complete rehabilitation cut of 40,000 board feet of logs would interest most operators and the offered price would normally be higher per thousand board feet than for small volumes. To sell 5,000 board feet per year or less the owner probably would have to dispose of the logs at the side of the road or haul the logs to the mill.

Stocking structure of the resulting stand.—Operable annual cuts for 9 years, together with girdling of culls reduced stand density and practically eliminated the harvestable trees on this 24-acre woodland. It will now be necessary to wait until enough trees have matured to again permit a minimum operable cut per acre. This will probably be 4 to 7 years. Because of the lack of large diameter trees it will be very difficult or impossible to sustain an operable annual cut on this small woodland.

If a complete harvest and improvement cut had been made at the start, the stocking structure would probably have been somewhat different than that of the present forest stand. The trees that were left (good growing stock) would have grown faster and there probably would be more larger trees. In effect, the annual cutting over 9 years traded a stimulation of growth on the better growing-stock trees for a more dispersed growth on the many trees left uncut. This must be considered a silvicultural sacrifice for the sake of an annual cut.

Reproduction.—The 9 years of annual cutting and girdling by the single-tree-selection method have not stimulated the establishment and vigorous growth of desirable reproduction. The light cuts made by single-tree-selection have resulted in very few openings in the overstory. Some of the small openings have been filled by the growth of large saplings and small poles that were present when the cuttings were made. At present the stand is fairly well stocked with poles of good species but desirable reproduction must be developed in the near future or the more tolerant and less desirable species such as hickory, blackgum (*Nyssa sylvatica* Marsh.), hard maple (*Acer saccharum* Marsh.), dogwood (*Cornus florida* L.) and sassafras (*Sassafras albidum* [Nutt.] Nees) will dominate the reproduction.

If desirable reproduction is to result, future cuts must create openings one-tenth to one-fourth acre or larger in size. Release work will also probably be required to free the desirable seedlings from competition. An effort should be made to get new seedling reproduction of yellow-poplar by scarification in the openings. A complete rehabilitation cut 9 years ago would have resulted in numerous openings and, probably, sufficient desirable reproduction. On a nearby area, 9-year-old yellow-poplar reproduction that became established after making a heavy improvement and harvest cut is 10 to 15 feet tall.

Future sustained yield.—Sustained yield depends on (1) growth at least equal to the cut, (2) a diameter distribution that continues to supply trees of harvest size, and (3) the continuous development of reproduction of desirable species. Only the first of these three conditions was met by using the single-tree-selection method on a 3-year cutting cycle in this farm woodland demonstration in central hardwoods. The second condition can be met in the present case only by a delay of several years in the cutting schedule and using a cutting cycle and cutting practices which will promote an appropriate stand structure for uneven-aged management. The third condition, successful reproduction, can be met by creating holes in the canopy by future cutting and by release of desirable seedlings where required.

Sustained yield on this and similar small woodlands of uneven-aged trees cannot be maintained by the annual operable cuts (with a 3-year cutting cycle) as practiced in this study. Time must be provided for development of an adequate diameter distribution and conditions must be provided for successful establishment of reproduction. Our experience indicates that the appropriate future practice in this stand would be (1) allow at least an operable cut of trees to grow into the 20 to 25-inch class, (2) make the next and subsequent cuts periodically by group selection to provide holes at least one-tenth acre in size, and (3) release desirable reproduction from competing brush as needed. Research on optimum stand density and structure of hardwood stands is now under way.

Photo Interpretation Provides a Good Estimate of Site Index of Fir, Hemlock, and Cedar[1]

J. Harry G. Smith
and Denes Bajzak

Field foresters require data on site quality as a measure of productivity to aid in management planning, an indicator of possible problems in reforestation, and a guide to optimum planning of logging and road building. In addition they will want results of research expressed in terms of components of the environment of a particular problem area most of which may be neatly summarized in terms of site index. Site index, being the height attained by representative trees at a reference age (100 years in this study), effectively integrates the factors that govern tree growth on a particular area. If the qualifying term "wet" or "dry" is added to site index, foresters will usually have all the information ordinarily required.

Determination of site index classes from aerial photos is relatively simple if stand age is known as in plantations or of little consequence as in old-growth stands. In both cases measurement or estimation of height can be used to assess site index directly.

Where stand age is not known, the forester must resort to measurements in the field, which are slow and expensive, or accept estimates based on aerial photos.

Photo estimates may be in terms of soils, geology, topography, physiography, forest cover types, or forest associations. All of these have some advantages in particular fields but assess forest productivity indirectly. The physiographic approach to site mapping as applied by Hills (*6*), Burger (*3*), W. G. E. Brown, and D. S. Lacate is the most promising of the indirect methods. However, although we studied the important components involved in physiographic site mapping intensively, no combination of factors proved as useful as direct estimation of site index. Direct estimation also has been employed by G. A. Choate and R. B. Pope for determination of site index of Douglas-fir in Washington and Oregon.

Area and Factors Studied

All of the area except the Pitt Lake slopes of the University of British Columbia Forest at Haney, B. C., was used for this study. The forest has been described by a Faculty of Forestry bulletin (*4*) and Griffith (*5*).

Photos used in the study were taken in 1958, at a scale of 1,250 feet per inch with a 12-inch focal-length camera, by the Photographic Survey Corp.

The forest was stratified by topographic site classes based upon aspect, percentage of slope, shape in profile, and shape in contour. Within these types, temporary plots were established in both young and old-growth stands. These amounted to 211 in the 25-year-old class and 26 in the old-growth. In addition, 83 permanent sample plots in the 75-year-old class were used. The average site index of the principal species present on each plot, usually Douglas-fir and western hemlock, was measured. Douglas-fir site indices were based on curves by McArdle, Meyer, and Bruce (*7*). Hemlock and cedar site indices were taken from Barnes' (*2*) tables for western hemlock.

The authors: Dr. Smith is an associate professor at the University of British Columbia. Mr. Bajzak was granted his M.F. there in 1960 and currently is employed by the Federal Department of Forestry in Newfoundland.

[1]Research Note No. 26, Faculty of Forestry, the University of British Columbia, Vancouver, B. C. Grants from the President's Committee on Research and the U.B.C. Forest, and a bursary from the National Research Council are gratefully acknowledged.

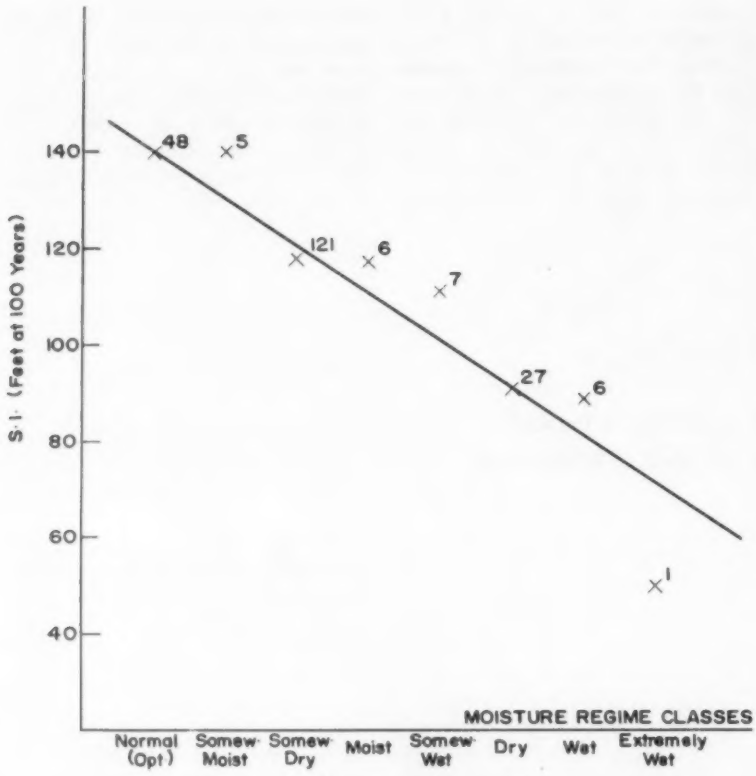

FIG. 1.—Site index on moisture regime.

Nine variables that could be measured or estimated from aerial photos were studied on each plot. These were: aspect, local position on slope, general position on slope, percent of slope, shape in profile, shape in contour, elevation, soil depth, and moisture regime. In addition to soil depth, and moisture regime as defined by Hills (*6*), permeability, soil texture, and thickness of humus and A_2 layers were measured in a pit on each plot. No influences of parent material other than those expressed by soil depth, texture, and moisture regime were apparent. Percent of stones and distance to the nearest creek were recorded for each plot. The most prominent lesser vegetation species and forest cover data were also noted.

Graphical and mathematical analyses were made of relationships among site index and the 13 variables studied. Details are given in an M.F. thesis by Bajzak (*1*) upon which this report is based.

Relationships Among Site Index and Individual Variables

Site index of all plots (320) ranged from 60 to 205, averaged 121, and had a standard deviation of ± 28 feet. Aspect and shape in contour were not significantly associated wtih site index. Site index decreased significantly (simple correlation coefficient or r was 0.368) with the following order of local position classes: middle slope seepage, S.I. 136; low slope seepage, S.I. 131; lower slope, S.I. 121; middle slope, S.I. 120; level, S.I. 118; ridge, S.I. 105; high slope, S.I. 104; and swamp, S.I. 81. The effect of general position on slope is about the same as the effect of local position with the exception of level situations which have the highest average site index, S.I. 133. Decrease of site index is slow on slopes from 0 to 20 percent; on slopes over 20 percent site index decreases rapidly with increase in slope percentage (r 0.191). So far as shape of topography is concerned, only concave curvature in profile and contour represents better site quality. Site index decreases slowly with increase in elevation to 800 feet. A small increase of site index occurs at 1,000 feet elevation, then site index decreases rapidly with increase in elevation (r 0.346). Site index increases significantly with increase in soil depth to 30 inches (r 0.187). Over 30 inches, the soil depth does not influence site quality. The most important and statistically significant factor is moisture regime (r 0.444). Optimum moisture regime is associated with an average S.I. of 140. Extremely wet soil represents the lowest site quality, S.I. 50.

Soil with rapid permeability represents the highest site quality. Slow permeability is associated with the poorest sites. Site index increases from coarse to fine textured soils. Thickness of the humus layer does not influence site quality significantly, although site index is lower on soil with a thin humus layer. Site quality decreases significantly with increase in thickness of the A_2 layer (r 0.168).

The best indicator of site index among the individual variables is moisture regime. This is illustrated in Figure 1.

Site Index From Combined Variables

Multiple regression analyses were made of site index on the thirteen variables studied for each and all age classes, to determine which combinations might prove most useful. Inclusion of all thirteen variables in estimates of plot site index provided a highly significant equation (R 0.56) but removed only 31.6 percent of the variation and gave a standard error of estimate (SE_E) of ± 23.7 feet. The nine photo-measurable variables were evaluated further by 29 multiple regression equations. The best two-factor equation was for site index on elevation and moisture regime which gave an SE_E of ± 24.3 feet. Using local position in addition to elevation and moisture regime reduced the SE_E to ± 23.8 feet and gave an equation almost as good as that with all 13 variables.

All of the equations determined by regression analysis were statistically significant but had errors

of estimate too high for many purposes.

Photo Interpretation of Site Index

With experience gained in collection of the field data just discussed Bajzak was in a good position to estimate site index directly from study of aerial photos, in an attempt to reduce the standard error of estimates. The graphical and statistical analyses had indicated which variables were the most important for correlating with site quality. Knowing the actual field relationships among the variables, Bajzak examined many topographic types stereoscopically on his aerial photographs. Next he estimated site indices in five-foot classes from the aerial photographs for numerous types and checked his estimates on the ground.

Finally, he estimated site index directly on photos for all of the 320 plots used in the study. His estimates accounted for nearly half the variation in site index with r 0.65 and a standard error of estimate of $\pm$ 16.4 feet. Thus it was shown that an interpreter with good knowledge of the local area could estimate average site index of a plot within one 30-foot site class about two times out of three.

Site Index of Individual Species

Following the estimate of average site index Bajzak developed a regression equation for estimate of average site index from each species. The average site index for Douglas-fir is 120 feet, for western hemlock 122 feet, and for western redcedar 113; the average for the three species is 119 feet on the area studied. On 152 plots, average site index equals 3.6 + 0.3 S.I. Douglas-fir + 0.4 S.I. hemlock + 0.3 S.I. cedar. Regression equations were also determined for calculation of site index of fir, hemlock, or cedar from any one of the species present on a plot.

Applications in Site Mapping

It is possible that the topographic types recognized in this study can be improved by direct use of moisture regime and other physiographic factors for stratification. Also, to the extent that they are controlled by physiography, the forest associations described by Dr. V. J. Krajina of the University of British Columbia can be recognized on aerial photographs of the U.B.C. Forest. However, when the topographic types used to stratify sample plots were classified by average site index and site index for Douglas-fir, the resulting maps were quite adequate for forest management. Field checks showed that the site index estimated for a type was within one 30-foot site class most of the time. Obviously, much time would have been saved had the direct approach been used initially. The best method would be to study plots of known site index on photos, consider the variables indicative of site, classify other areas by direct estimation of site index, and confirm the resulting types by field sampling.

Conclusion

After study of 13 variables on 320 plots, it was evident that direct estimation of site index gave a good assessment of the site index of fir, hemlock, and cedar and was easier to apply than any indirect approach to site evaluation.

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Investigation of Natural Regeneration of Pond Pine

D. M. Crutchfield and I. F. Trew

IN EASTERN North Carolina, pond pine (*Pinus serotina* Michx.) usually occurs on wet flats and extensive, poorly drained evergreen-shrub bogs called "pocosins" with organic soils varying in depth from one to 25 feet (*6*). Pond pine is a major component of nearly two million acres in this area (*5*).

The regeneration of pond pine is hampered by two problems. First, pond pine cones are serotinous, requiring heat to open the sealed cone scales. Second, the continual moistness of the organic soil provides an excellent growth medium for intense competitors: trees, evergreen brush[1], and switch cane (*Arundinaria tecta*) (Fig. 1). Up to ten tons per acre, oven-dry basis, of understory plant material have been measured in pond pine stands.[2] Switch cane is a reed-like grass which grows ten to 15 feet in height. Wildfire has been chiefly responsible for switch cane regeneration from sprouts. Under fire protection and grazing switch cane stands tend to be replaced by evergreen shrubs (*5*).

Wildfire has been responsible for the regeneration of pond pine stands in the past. Fire removes competition, exposes the soil and causes the seed to fall. Most of the plants associated with pond pine on organic soil are capable of resprouting from stumps and roots. The pond pine type is noted for high frequency and large acreage of wildfires (Fig. 2).

THE AUTHORS are with the West Virginia Pulp and Paper Company, New York City, and the Charlottesville Research Center, West Virginia Pulp and Paper Company, Ivy, Va., respectively.

At the time this research was conducted they were research foresters, Manteo Research Center, West Virginia Pulp and Paper Company, Manteo, N. C.

[1]Mainly gallberry (*Ilex glabra*), swamp ironwood (*Cyrilla racemiflora*), redbay (*Persea borbonia*), waxmyrtle (*Myrica cerifera*).

[2]Personal communication.

In the summer of 1956 a study was undertaken in northeastern North Carolina by the West Virginia Pulp and Paper Company with the objective of improving natural regeneration of pond pine on organic soil.[3] It was first necessary to obtain reliable data on periodicity, quantity, and viability of pond pine seed fall. This was determined through use of quarter-milacre seed traps. Stocking information was obtained by recording the number of seedlings in transects consisting of 100 contiguous milacre plots for each treated area.

The pattern of seed fall for pond pine differs from the other common serotinous pine species. Sand pine (*Pinus clausa* Chapm. Vasey) releases very little seed naturally from cones on standing trees, the few released falling during the hottest summer months (*2*). Jack pine (*Pinus banksiana* Lamb.) cones may disseminate seed during any season of the year although they open best during seasons with dry weather and high temperature (*4*). Lodgepole pine (*Pinus contorta* Dougl.) disseminates seed from standing trees throughout the year but the majority is shed from October to June of the following year (*3, 6*).

Pond pine stands studied exhibited two periods of seed fall per year: April through September and October through January. The first period appears to coincide with the hottest temperatures of the year whereas the second is similar to the seed dispersal period of other pine species. These two periods were found to pertain both to an undisturbed stand and to stands cut to 8 seed trees per acre.

Volume of seed caught in traps averaged about 3,000 sound seed per acre per year for the undisturbed and unburned seed tree stands. From two uncut but burned stands the average was 53,000 sound seed per acre over a six-week period following the burn.

Soundness of seed collected in

[3]Assistance in design of this study was provided by personnel of the Franklin Research Center, Southeastern Forest Expt. Sta., Forest Service, U. S. Dept. Agric., Asheville, N. C.

FIG. 1.—Natural stand of pond pine showing density of switch cane understory.

seed traps varied greatly. Seed released immediately following a fire averaged 77 percent in soundness, seed from unburned seed trees averaged 49 percent sound, and seed from an undisturbed stand averaged 12 percent. The reason for differences in seed soundness may be due to age of seed. Fire causes release of seed simultaneously from cones one to five years old. The naturally shed seed comes from older cones that open individually following several years of weathering and insect depredations.

The plots involving the use of fire were burned in May 1957. Five 18-acre plots were burned and treated as follows: burn prior to clearcutting; clearcut prior to burning; cut to eight seed trees per acre prior to burning. The fire was intense, consuming virtually all fuels in the understory and reaching into the pond pine canopy on the burn-clearcut plot. The intense burn eliminated the competition, exposed the seedbed and released the seed; however, a fire of lesser intensity would also have accomplished these ends. Because of the logging slash and heavier fuels there were more localized hot fires on the clearcut-burn plot than on the burn-clearcut plot.

The plots in which mechanical implements were used to prepare seedbeds were treated in July and August 1956. The following implements were employed, striving for complete treatment of each eight-acre plot: 2-disk fire plow, rolling-type brush drum, and a bush and bog disk. The treatment with the fire plow was better than those with the rolling-type brush drum and bush and bog disk. Treatments were effected prior to logging to eight seed trees per acre.

The difference in time of treatment between the burned and the scarified plots was caused by the lack of favorable burning conditions at the time the plots were scarified. The lapse in time was not felt to be significant as germination was not evident on the scarified plots until April 1957.

The relative effectiveness of the techniques tested to secure regeneration was based upon the number of free-to-grow seedlings estab-

Fig. 2.—Natural pond pine regeneration two growing seasons after a severe wildfire which consumed up to two feet of organic soil.

Fig. 3.—Pond pine seedlings resulting from the burn-clearcut treatment of this study.

Table 1.—Free-to-Grow Seedlings by Treatment

Treatment	Fall 1957		Fall 1958		Fall 1959	
	Percent stocked	Number per acre	Percent stocked	Number per acre	Percent stocked	Number per acre
8-seed trees/acre, no burn: control (7/56)	5	60	4	50	1	50
8-seed trees/acre, no burn: drummed (7/56)	18	320	11	210	11	290
8-seed trees/acre, no burn: disked (7/56)	12	230	5	100	11	150
8-seed trees/acre, no burn: fire-plowed (7/56)	24	430	21	450	30	510
Burned prior to clearcutting (5/57)	74	3,830	46	1,800	52	2,000
Clearcut prior to burning (5/57)	56	1,390	41	670	40	755
8-seed trees/acre prior to burning (5/57)	35	760	19	285	20	320

lished per acre. Based upon the number of such seedlings at the end of the third growing season, the following treatments were deemed acceptable: burn prior to clearcutting (Fig. 3); clearcut prior to burning; fire-plowed, seed trees left but without burning (Table 1).

There was no apparent reason why plots cut to eight seed-trees per acre and burned did not restock satisfactorily. Actually two plots received this treatment and both exhibited low stocking even though one plot was logged February through April, the other January through February. The burning of cone-bearing slash was as complete on the clearcut-burn plots, demonstrating the best third year free-to-grow stocking, as on plots having eight seed trees per acre. Scarification with the rolling brush drum, and with the bush and bog disk did not expose the soil sufficiently to produce a good seedbed.

Two of the acceptable treatments involved the use of burning —at best a risky business in pond pine types. The third acceptable treatment, site preparation with a fire plow prior to logging, resulted in a moderately stocked stand without the use of fire. Seed supplied from eight seed trees per acre and logging slash was adequate to stock the fire plow treated area.

Based upon the stocking data, fire provides a better seedbed than the mechanical treatments. Disturbance of the soil and elimination of competing vegetation, however achieved, resulted in favorable seedbed conditions. Regrowth of the competition was rapid and seedbeds prepared in late summer remained receptive for only four months.

Seedlings were identified as free-to-grow at the end of the first, second, and third growing seasons. Regrowth of brush and switch cane required a re-evaluation of the free-to-grow basis at each inspection. At the end of the third season the seedlings were now emerging from the gallberry and switch cane competition.

Further investigation of the burn-clearcut and clearcut-burn treatments are needed. A new study, the "Organic Soils Forest Fire Research Project" will provide information on fuels and fire behavior in pond pine types. This study is sponsored by the Division of Fire Research, Southeastern Forest Experiment Station, North Carolina Forest Service, and industrial forestry concerns.

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BUYER of the first sheet of the new Range Conservation Commemorative Stamp was Secretary of Agriculture Orville L. Freeman, center, shown receiving the stamps from Postmaster General J. Edward Day, right, as Dr. Richard E. McArdle, chief of the U. S. Forest Service, looks on. The new stamp, designed by U. S. Department of Agriculture artist Rudolph Wendelin, symbolizes the progress of range management since the days of the open range and the Trail Boss. It was officially issued February 2 at Salt Lake City during ceremonies at the annual meeting of the American Society of Range Management.

Length of Stratification and Germination of Loblolly Pine Seed

B. F. McLemore and
Felix J. Czabator

To INCREASE the completeness and particularly the rapidity of germination, loblolly pine (*Pinus taeda* L.) seed is customarily stratified in a cold, moist medium, as recommended by Barton.[1] Such enhancement of germination is important not only in nursery sowing, but particularly in direct seeding. Overemphasis in completeness of germination, however, has been such that 30 years of practice have not resulted in agreement as to the optimum duration of stratification.[2, 3] The study reported in this paper utilized a formula that combines rapidity with completeness of germination to evaluate the response of 29 lots of loblolly pine seed to stratification.

Germination Value

Conventional tests appraise only total germination after a specified length of time—generally 30 days for loblolly pine. Early onset and rapidity are not considered so long as the bulk of germination is completed before the end of the test. Differences in rapidity are apparent when cumulative germination curves are plotted, but few seed testers prepare such graphs.

Czabator[4] has developed a formula by which both speed and completeness of germination can be evaluated without laborious plotting of tests and subjective interpretation of results. Mathematical expressions of germinative energy and germinative capacity are combined into a single *germination value.*

The calculation of germination value is relatively simple, and does not require any change in procedures for standard germination tests. At the close of a test, the daily gross counts are converted to full-seed germination percents, and averages of replicate tests are tabulated as cumulative germination percents against the number of days since the beginning of the test (Table 1). This is the standard procedure for recording any germination test.

The maximum germination percent (total at the end of the test) is divided by the number of days to the end of the test. The quotient is the *mean daily germination* (MDG) of the seed sample.

Working back from the end of the test, successively earlier cumulative germination percents are divided by the number of days needed to reach these percents (Table 1). Quotients generally increase until a *peak value* is reached, after which they tend to diminish. This peak value is the mean daily germination of the most vigorous component of the seed lot, and the day on which it occurs is called the peak day. The earlier the peak day, for any given germination percent, the greater will be the peak value and the better the seed from the standpoint of promptness and rapidity of germination.

TABLE 1.—GERMINATION OF A TYPICAL LOT OF SEED, SHOWING METHOD OF COMPUTING GERMINATION VALUE

Days of test	Cumulative Germination	Ratio of days to germination percent
	Percent	
10	20	2.00
11	33	3.00
12	48	4.00
13	65	5.00
14 (peak day)	77 (peak value)	5.50
15	80	5.33
16	82	5.12
17	85	5.00
18	86	4.78
30	90 (mean daily germ.)	3.00
Germination value=5.50×3.00=16.50		

Mean daily germination is multiplied by peak value to give as a product the *germination value* previously mentioned.

Occasionally, in lots with low vigor, the peak value does not develop, and the highest quotient is that at the end of the test, the MDG. In such cases, MDG is considered to be peak value also, and germination value = MDG squared.

The factors used in calculating germination values are well defined and, within reasonable limits, are independent of the frequency with which germinated seed is counted. The true peak value may be missed in vigorous lots if germination counts are made too infrequently, or if the first count is made after the peak has passed. Even if peak value has been missed, however, valid comparisons of germination values of different lots of seed, or of lots receiving different treatments, may be made if the frequency of counts has been the same for these lots or treatments.

The germination-value formula was designed as a simple device for evaluating the over-all vigor of a seed lot or the results of presowing treatment. Either speed of germination or earlier onset of germination carries more weight than completeness, although lots of seed with more complete germination, but with identical speed, will have higher germination values. The germination values of seed lots with identical total germination vary with the speed of

THE AUTHORS are members of the Southern Forest Expt. Sta., Forest Service, U. S. Dept. Agric., New Orleans, La.

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[4] Unpublished data of the Southern Forest Expt. Sta.

TABLE 2.—GERMINATION VALUES FOR 29 LOTS OF LOBLOLLY PINE SEED ACCORDING TO LENGTH OF STRATIFICATION

Seed lot	Seed stratified for— 0 days	15 days	30 days	45 days	60 days
	Germination values				
A	8.05	14.89	20.00	26.42	28.96
B	2.28	14.36	20.59	27.17	29.57
C	2.02	8.63	9.87	10.95	12.01
D	9.71	9.33	11.81	12.41	18.14
E	7.06	13.57	11.09	17.94	20.94
F	3.50	14.51	21.58	25.84	29.72
G	7.02	19.22	25.37	29.76	31.07
H	3.69	17.71	25.81	27.63	31.56
I	4.28	19.85	27.09	31.18	32.87
J	.90	9.55	11.42	16.18	16.18
K	.94	9.38	26.43	30.20	33.03
L	7.38	15.47	21.81	28.05	30.52
M	4.12	16.52	24.47	26.22	29.64
N	.49	13.11	21.58	27.34	30.04
O	5.86	12.13	14.20	18.66	17.88
P	.25	10.35	18.90	26.74	27.32
Q	4.45	16.71	18.91	28.68	33.03
R	10.44	19.15	27.12	28.93	32.97
S	.36	14.33	23.45	29.06	32.30
T	4.54	14.85	23.71	27.88	31.20
U	.97	.20	.36	1.43	.44
V	10.28	17.39	22.33	26.18	32.67
W	4.41	27.56	26.24	27.58	31.33
X	2.34	16.01	24.22	27.62	31.65
Y	5.43	10.19	17.16	21.18	20.67
Z	11.12	14.89	16.73	23.96	25.08
AA	1.44	9.62	17.50	23.32	26.10
BB	9.73	20.56	24.35	22.39	30.55
CC	1.72	13.20	22.80	28.37	31.65
Average	4.65	14.25	19.89	24.11	26.86

TABLE 3.—TOTAL GERMINATION PERCENTS FOR 29 LOTS OF LOBLOLLY PINE SEED ACCORDING TO LENGTH OF STRATIFICATION

Seed lot	Seed stratified for— 0 days	15 days	30 days	45 days	60 days
	Percent				
A	96	96	91	98	96
B	91	95	94	98	96
C	86	70	68	64	62
D	92	72	73	66	76
E	85	90	86	79	82
F	96	100	99	98	97
G	97	98	96	98	96
H	92	98	100	98	98
I	96	99	99	99	100
J	75	80	76	82	74
K	90	94	100	99	100
L	96	98	98	99	97
M	92	98	99	96	95
N	97	96	98	98	97
O	83	82	80	82	75
P	50	94	96	96	92
Q	94	98	96	98	100
R	96	100	100	98	100
S	94	99	99	98	100
T	94	96	100	98	98
U	33	12	14	26	12
V	97	97	98	96	99
W	95	99	98	98	97
X	90	96	98	97	98
Y	86	89	88	88	80
Z	93	90	90	93	89
AA	90	88	92	94	92
BB	98	99	99	88	98
CC	69	90	96	98	98
Average	88	90	90	90	89

germination; the germination values of seed lots with identical speeds vary with total germination.

Study Methods

In the present study, samples of 29 lots of loblolly pine seed from sources throughout the South were stratified for 0, 15, 30, 45, and 60 days. The various lots had been stored from 3 months to 5 years. Portions of the individual lots were wrapped in cheesecloth and stratified in moist vermiculite at 36°F. All together, there were 145 stratification sublots.

A single sample of 200 seeds from each sublot was tested and its cumulative germination recorded. As all empty seeds had been floated off, test samples were 100 percent full seed. All tests were conducted under standardized conditions in the seed-testing laboratory of the Southern Forest Experiment Station's Alexandria Research Center. Tests continued until germination was complete.

Germination was complete at 90 days for seed that was unstratified or that had been stratified 15 days. It was complete at 75, 60, and 45 days for seed stratified 30, 45, and 60 days. Germination values were based on mean daily germination at 30 days. Total germination percent at the end of each test was also determined.

Results

Germination values.—With one exception, germination values were substantially increased by stratification (Table 2). Most lots benefited from 15-day stratification, and, on the average, this treatment increased the germination value 9.60 points over unstratified seed. Extending the stratification period to 30, 45, and 60 days increased germination values, but by diminishing amounts—5.64, 4.22, and 2.75, respectively.

An *F* test of the germination values in Table 2 indicated that the differences between treatments and between individual lots of seed were highly significant. When Duncan's multiple range test[5] was applied to arrayed treatment

[5]Duncan, David B. Multiple range and multiple *F* tests. Biometrics 11:1-42. 1955.

means all differences between mean germination values were significant at the 0.01 level. Thus, each lengthening of the stratification period, up to 60 days, very significantly increased germination value.

In evaluating the data in Table 2 it should be noted that lots stratified for 60 days were penalized because no germination counts were made before the tenth day, after the peak day had passed for most of these lots. Nevertheless, the germination values were consistently higher for 60-day stratification than for shorter treatments.

Only lots D and U failed to respond to 15-day stratification when speed and completeness of germination were evaluated jointly. Lot D was very erratic, with a reduction in germination value after 15 days of stratification, an increase after 30 days, almost no additional increase after 45 days, and a substantial increase after 60 days of stratification. Lots E, O, U, W, Y, and BB were also erratic. In contrast, 22 of the lots showed a consistent response to increased length of stratification.

Speed of germination.—The germinative energy of all lots was increased by stratification, i.e., progressively faster germination was obtained by lengthening the stratification period (Fig. 1). For unstratified seed, the bulk of germination was not complete until 60 days had elapsed (bulk of germination of a seed sample is here used to mean 95 percent of total germination attained by the sample). In contrast, seed stratified 60 days achieved its bulk of germination within 10 days.

Total germination.—Stratification appreciably increased total germination of 4 lots, K, P, X, and CC, and decreased total germination of lots C, D, O, and U. The other lots were virtually unaffected (Table 3). Where germination was decreased by stratification, the 15-day period appeared to be as harmful as the longer periods. For lots in which total germination was increased, 15 days was as effective as longer stratification.

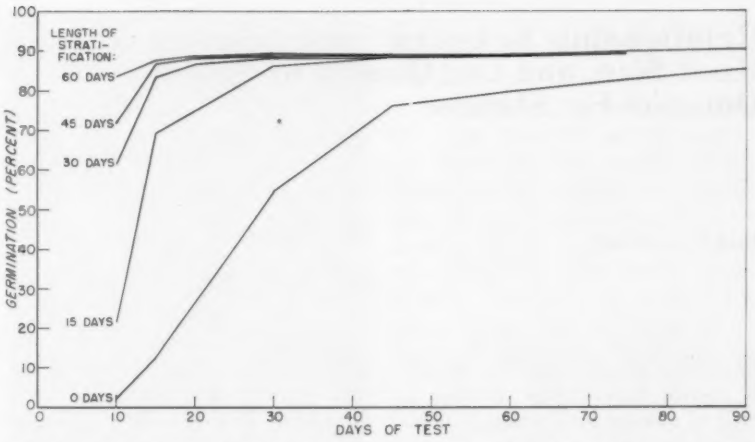

Fig. 1.—Cumulative germination (average of 29 lots) following 5 different periods of stratification. Tests after 0, 15, 30, 45, and 60 days' stratification were terminated at 90, 90, 75, 60, and 45 days, respectively.

Discussion and Conclusion

Examination of the total germination percents in Table 3 may demonstrate the usefulness of the germination-value formula and concept. Germination percents of nearly all individual lots, and averages of all lots, vary so little with different lengths of stratification that it would have been impossible to evaluate the effect of these treatments by considering final germination percent alone (Fig. 1). On the other hand, germination values, which resemble cumulative germination curves in reflecting real differences in speed or vigor of the lots, clearly show the effects of different treatments.

Without calculating germination values, it would have been difficult to determine if the hastening of germination by stratification compensated for the decreased germination of lots C, D, O, and U. However, the germination values in Table 1 indicate that lots C, D, and O were benefited while lot U was possibly harmed. Germination of lot U was so low, regardless of treatment, that the lot would have been unusable in direct seeding and undesirable for nursery use. While lot U's drop from 33 percent to 12 percent after stratification lessened the germination value, a similar loss at a higher percentage of germination did not lower the germination value of lot C.

How long a particular seed lot should be stratified will depend on the purpose for which the seed is to be used. In general, seed users interested in obtaining maximum germination soon after sowing may prefer 60-day stratification.

Especially in direct-seeding operations, seeds remaining on the ground for a long time are less likely to germinate than when they are in a seed laboratory. Furthermore, seeds that germinate late in the spring are usually worthless because the seedlings will succumb to the hot, dry weather of summer. In the tests reported here, approximately 70 percent of the lots responded to 60-day stratification with germination of over 90 percent within 10 days or less.

The germination periods reported above for seed stratified for different lengths of time must not be expected for all lots of seed. They should be considered only as averages, since all seed lots do not react alike.

The variation among lots emphasizes the desirability of testing seed both without stratification and after stratification for different lengths of time.

Relationship Between Tree Spacing, Knot Size, and Log Quality in Young Douglas-Fir Stands

Rudolf F. Grah

STOCKING in reproduction stands is known to influence volume as well as quality production in older stands derived from them. Assuming enough well distributed trees to occupy the site (at least toward the middle and latter parts of the rotation), the effect of stocking on volume output may become insignificant by rotation age. However, the effect of spacing on quality will be of longer duration (*2*). This is particularly true with respect to two important determinants of log quality—distribution and size of knots.

Since knots constitute a grade defect on peeler or sawmill logs, and thus reduce their value, it is important that the forest manager be familiar with factors affecting knot size and distribution. With such knowledge, stands may be manipulated to achieve highest value output or other management objective. Stocking as expressed by tree spacing is a production factor over which the manager has a large degree of control either through planting or early thinning. This, in turn, gives him a degree of control over log quality. The purpose of this study was to investigate the relationship between tree spacing and the size and distribution of knots in 20- to 40-year-old Douglas-fir (*Pseudotsuga menziesii* [Mirb.] Franco) stands, and to note its influence on present and future log quality.

Tarbox and Reed (*5*) found that knot size increased in eastern white pine as space between trees increased. Eversole (*1*) reported similar results from studies of 27-year-old Douglas-fir plantations, in which average knot size became larger as tree spacing increased from 4-by-4 to 12-by-12 feet. His study, however, did not attempt to interpret these particular findings in terms of their direct effect on log quality. Other studies have shown it is unlikely that log quality, as determined by knot size and distribution in the early stages of stand development, will change much over rotation periods of 60 to 80 years, and thus the quality of butt logs may be fixed at an early age. This follows from the fact that knot formation in the lower 16-foot log occurs during the first 20 to 30 years in the life of the stand. As Kachine (*3*) has shown for Douglas-fir, natural pruning and overgrowing of the limb stubs will not remove evidence of these knots before age 80 to 100 years.

Field Procedure

Natural stands of Douglas-fir (Figs. 1, 2) were sampled in order to study the relationship between spacing and log quality as influenced by knot size. While spacing in such stands is not formally arranged as in plantations, it exerts a similar influence. Natural stands offer a wide range of spacing values for study, and present realistic log quality problems relating to stocking. Results of the study, however, may be applicable

THE AUTHOR is lecturer in forestry, School of Forestry, University of California, Berkeley.

FIG. 1.—Forty-year-old stand of Douglas-fir showing a tree with limbs in excess of 2½ inches in diameter on a quadrant where tree spacing is in excess of 18 feet.

FIG. 2.—Limbs on trees in foreground are less than 1½ inches in diameter and average tree spacing is less then 12 feet.

to both naturally and artificially regenerated stands.

One-fifth acre plots were laid out in 35- to 40-year-old stands in Humboldt County, California. The plots were located to permit sampling of uniform portions of stands representing discrete steps in stand spacing densities. The stands studied had originated from an invasion of grass covered areas following fire or other disturbance, and represented a wide range of initial stocking densities. Spacing ranged from open-grown trees down to those with an average spacing of 4-by-4 feet or less. Site was judged to be 150 feet at 100 years (equivalent to high site III), based on average height of dominant and codominant trees.

Current stand density was determined by counting the number of trees on each plot and converting to an acre basis. Since the exact number of live stems per acre present in the stands during past periods was not known, stands were reconstructed as of approximate age 20 years by adding the number of dead and down stems found on the plots to the number of currently live stems. Criteria for determining if a dead stem had been alive at age 20 were height and condition of bark and wood. These criteria were highly subjective, but it was believed that time of death could be estimated to within five years of the true time of death.

The diameter of each limb on the butt 16-foot log of live trees was measured to the nearest ¼ inch by means of a fixed-slot caliper mounted on a 10-foot pole (Fig. 3). The butt log only was used because it was most convenient to measure and its quality is most directly affected by initial stocking of the stands. Limb measurements were made flush with the bark of the main stem. When limb bark thickness was a critical factor in deciding limb diameter class, the bark was knocked off the limb with the edge of the caliper, and a measurement was made directly on the two bare wood surfaces of the limb. The present condition of the limb with respect to its being alive or dead and the location of each knot

FIG. 3.—A fixed-slot caliper was used to measure limb diameters. It is shown here leaning against an open grown tree with limbs in excess of 2½ inches in diameter.

were recorded on a log diagram sheet arranged by cardinal quarters. The distance to the nearest tree in each cardinal 90-degree arc from the subject tree was measured and its crown class and diameter recorded.

Analysis

The analysis of knot size in relation to spacing at age 20 was initially undertaken by averaging knot size for each tree on individual plots. However, in spite of the fact that plots were chosen for uniform density, the spacing of individual trees in the plots proved to be too variable, and no consistent trend in knot size by plot-stocking class was found. The procedure was therefore reorganized so that each tree and its immediate neighbors in 90-degree quadrants were used as analytical units.

For this approach those trees exhibiting uniform distance from neighboring trees in each quadrant were included for analysis. Average knot size for each tree was calculated and related to average distance to the nearest tree in all quadrants. In order to describe this relationship, a regression analysis was run using average knot diameter as the dependent and average tree spacing as the independent variables and an equation derived for the relationship.

The relationship between average knot diameter and tree spacing is of general interest to the manager of forest stands but shows general interrelationships only. Of greater interest is the direct effect of spacing on measurable stand-quality characteristics such as log grade. Since the size and placement of individual knots are important log grade determinants, an analysis was made of these characteristics on each of the butt logs studied. To evaluate these characteristics three categories of critical knot sizes were established to correspond to maximum sizes admissible in the various log grades established by the Puget Sound Log Scaling and Grading Bureau (*4*).

Under the log grading rules, knot-size limits are specified for number 3 peeler logs and number 2 and 3 sawmill logs. Number 1 and 2 peeler logs and number 1 sawmill logs were excluded from the analysis since they must be substantially clear and are normally not found in young-growth stands of the type considered in this study.

According to the log grades used, knots with diameters in excess of 1½ inches disqualify the log from the number 3 peeler grade. Logs with knots were 2½ inches in diameter, distributed so that less than 65 percent of net content is recoverable as number 1 common or better lumber are disqualified from the number 2 sawmill log grade. With these knot specifications in mind, log diagrams were studied. Large, single knots or knot whorls located less than 6 inches from the end of the log were disregarded since it was assumed that these could be removed in trimming logs or derived products. While not specified in the Rules, a criterion of at least one knot over the critical diameter for each grade occurring on three or more faces of the log was used in addition to the above in applying the grade specifications to the study logs.

Limbs on the butt logs on all but the fully open-grown trees were dead. Live limbs on open-

grown trees were still increasing in diameter, but were for the most part larger than 2½ inches in diameter.

A summary was made of grade-defect knots on each log diagram by one-foot tree spacing categories, and average knot sizes were calculated for each category. The findings appear in Table 1.

Results

The data indicate a close relationship between average knot diameter and average tree spacing over the stands included in this study wherein knot diameter increases with increase of tree spacing. The relationship is described by the following equation:

$$y = -0.1355 + 0.0889x$$

Where: y = average diameter of knots in the butt log in inches

x = average spacing between trees in feet

Analysis of variance showed the relationship to be significant at the one percent level.

Average knot diameter values obtained from field measurements and those calculated from the above equation for stands with an average spacing of 4-by-4 and 12-by-12 feet are 0.27 and 0.84 inch, respectively, for the tabulated values and 0.22 and 0.93 inch for the calculated values. These compare reasonably well with Eversole's findings for plantations. For equivalent spacings, he reported average diameters of limbs immediately above and below the diameter breast height point to be 0.36 and 0.73 inch respectively. This comparison indicates no substantial difference in quality performance (with respect to knots) between young natural stands and plantations.

Applying the results of this study to the influence of knot size and occurrence on log grades within such stands, the data show that 100 percent of the butt logs in stands with an average spacing of 16 feet or greater developed knots of over 1½ inches in diameter, which would disqualify them from the number 3 peeler log grade. About 70 percent of the trees grown at that spacing had grade-defect knots larger than 2½ inches, disqualifying the butt logs from the number 2 sawmill log grade. One hundred percent of the trees grown at an average spacing of 18 feet or more contained knots larger than 2½ inches, disqualifying these logs from the number 2 sawmill log grade.

TABLE 1.—SIZE AND NUMBER OF KNOTS IN RELATION TO AVERAGE TREE SPACING (16 FOOT BUTT LOG SITE III DOUGLAS-FIR, HUMBOLDT COUNTY, CALIFORNIA)

Average spacing between trees	No. of trees measured	Average knot diameter		Knots with diam. greater than: 1½ inches		2½ inches	
		Measured	Predicted[2]	Av. no. per log[3]	Trees with knots	Av. no. per log[3]	Trees with knots
Feet		*Inches*	*Inches*		*Percent*		*Percent*
3	0	.....	0.13	.....	.....	.....	.....
4	3	0.27	0.22	0	0	0	0
5	5	0.33	0.31	0	0	0	0
6	5	0.40	0.40	0	0	0	0
7	5	0.40	0.49	0	0	0	0
8	7	0.58	0.58	0	0	0	0
9	4	0.59	0.67	0	0	0	0
10	9	0.65	0.75	0	0	0	0
11	4	0.85	0.84	0	0	0	0
12	6	0.84	0.93	4	20	0	0
13	5	1.13	1.02	12	60	3	20
14	9	1.14	1.11	8	67	5	33
15	5	1.19	1.20	14	80	13	40
16	7	1.38	1.29	25	100	14	71
17	8	1.53	1.38	32	100	13	75
18	6	1.31	1.47	18	100	6	100
19	3	1.64	1.55	26	100	9	100
20	2	1.98	1.64	28	100	33	100
21	5	1.90	1.73	38	100	21	100
22	4	1.54	1.82	41	100	13	100
23	1	2.54	1.91	48	100	39	100
24	..	.....	2.00	.....	.....	.....	.....
25	..	.....	2.09	.....	.....	.....	.....
26	3	2.02	2.18	48	100	40	100
Open[1]	5	3.50	.....	60	100	60	100

[1]Average spacing greater than tree height. Data not included in regression since no precise measure of spacing in feet could be assigned.
[2]Predicted from regression equation $y = -0.1355 + 0.0889x$.
[3]Distributed over three or more quarter faces of log, and not located within six inches of end of log.

Conclusions

1. A close relationship exists between knot size and an average spacing between trees in young, natural Douglas-fir stands. Average knot size increases with increase in average spacing.

2. The relationship obtained is a linear one between average tree spacings of 4-by-4 to 26-by-26 feet, the range covered by this study.

3. Grade of the butt log as influenced by size and occurrence of knots is affected by spacing. For example, this study shows four butt logs in natural stands of site III quality grown at an average spacing of 16 feet or greater:

   a. Most logs will have knots too large to admit them to a number 3 peeler log grade.

   b. Seventy percent will have knots too large to admit them to a number 2 sawmill log grade.

4. Where average spacing is 18 feet or more on site III a major portion of the butt logs will qualify for no grade higher than a number 3 sawmill log because of excessively large knots.

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Statistics from Schools of Forestry for 1960: Degrees Granted and Enrollments

Gordon D. Marckworth

This article is another in a series of comparable papers appearing annually in the JOURNAL OF FORESTRY *since 1934, reporting the enrollment at the schools of forestry and the numbers of degrees conferred. Statistics of this type were first assembled when the Forest Education Inquiry made its study in 1929-1931, and were published in the Inquiry's report of 1932.*[1] *The annual articles in the* JOURNAL *have brought to date the figures for each successive year.*[2]

THE INCREASE in undergraduate enrollment which began in the 1953-1954 scholastic year has continued, and this year totals 4.2 percent, increasing from 8,101 to 8,439—last year the increase was 3.0 percent. This is the largest enrollment on record and surpassed that in 1948 which totaled 8,212. All classes show an increase in enrollment (Table 6).

THE AUTHOR is dean of the College of Forestry, University of Washington, Seattle.

[1]Graves, H. S., and C. H. Guise. Forest education. Yale Univ. Press, New Haven.

[2]Guise, C. H. (Eighteen articles on degrees granted and enrollments at schools of forestry in the United States, 1934-1950). Jour. Forestry 32:337-343; 33: 402-405; 34:114-120; 35:77-83; 36-12-18; 37:197-202; 38:241-246; 39:359-364; 40:196-202; 41:87-91; 42:357-360; 43: 172-175; 44:110-114; 45:174-180; 46: 168-173; 47:93-100; 48:165-169; 49:7-12.

Marckworth, Gordon D. Jour. Forestry 50:262-265; 51:256-259; 52:354-358; 53: 256-261; 54:316-321; 55:115-121; 56: 129-135; 57:111-116; 58:188-194.

General forestry accounts for 71 percent of the enrollment in the combined junior and senior classes; *wildlife management* ranks second with 11 percent and *wood technology and utilization* follows with approximately 5 percent. The master candidates decreased from 609 to 604 and the candidates for the doctorate increased from 247 to 312. Of the total graduate enrollment of 916, 53 percent are in *general forestry;* 17 percent in *wildlife management;* and 16 percent in *wood technology and utilization.*

The number of bachelor degrees granted increased from 1,528 in 1959 to 1,532 in 1960 of which 1,054 were in *general forestry,* 93 in *wood technology and utilization* and 163 in *wildlife management.*

The number of master degrees granted increased from 248 to 305 of which 177 were in *general forestry,* 29 in *wood technology and utilization,* and 63 in *wildlife management.*

The number of doctor degrees granted decreased from 42 to 40 of which 20 were in *general forestry,* 8 in *wood technology and utilization,* and 8 in *wildlife management.*

From 1900 through 1960 there have been 29,844 undergraduate forestry degrees granted in tne United States. In addition 5,344 master degrees and 575 doctor degrees have been granted (Table 10).

Introduction

The 1960 statistics from the schools of forestry in the United States are on the same basis as for 1959 except that the University of Arizona at Tucson has been added to the non-accredited group. Thus the number of non-accredited schools has been increased to 15 and the total to 43.

It has been customary to carry the statistics on the number of degrees granted on a calendar year basis and, since the reports are requested in October, the schools operating on a quarter basis have to estimate the number of degrees which will be granted at the end of the autumn quarter. It thus becomes necessary to correct these estimates at the end of the year. For this reason the totals listed for 1959 in the current compila-

TABLE 1.—SIGNIFICANT STATISTICS FOR 1951 THROUGH 1960

	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
Bachelor degrees conferred	1,564	1,267	1,045	957	829	887	1,172	1,362	1,528	1,532
Master degrees conferred	267	226	151	179	194	233	207	224	248	305
Doctor degrees conferred	21	25	37	44	31	34	44	41	42	40
Undergraduates enrolled	4,799	4,691	4,909	5,357	6,038	6,933	7,395	7,866	8,101	8,439
Members of freshman class	1,370	1,536	1,698	1,986	2,149	2,220	2,230	2,516	2,569	2,706
Members of sophomore class	1,107	1,012	1,168	1,377	1,566	1,807	1,831	1,860	1,948	2,048
Members of junior class	1,053	1,013	917	1,032	1,236	1,549	1,759	1,718	1,774	1,866
Members of senior class	1,269	1,130	1,126	962	1,087	1,357	1,575	1,772	1,810	1,819
Graduate students—master	344	281	349	423	405	430	500	537	609	604
Graduate students—doctor	137	130	139	127	161	165	179	207	247	312

TABLE 2.—BACHELOR DEGREES GRANTED FOR COMPLETION OF STUDIES IN SPECIALIZED FIELDS AT SCHOOLS OF FORESTRY IN THE UNITED STATES—CALENDAR YEARS 1959 AND 1960

	General forestry		Wood technology		Range management		Wildlife management		Forest recreation		Others		Totals	
	1959	1960	1959	1960	1959	1960	1959	1960	1959	1960	1959	1960	1959	1960
Accredited schools														
Alabama	26	34	2	3	—	—	—	—	—	—	—	—	28	37
California	27	25	—	—	—	—	—	—	—	—	—	—	27	25
Colorado	27	15	2	4	9	22	20	14	11	6	3	1	72	62
Florida	13	16	—	2	—	—	3	—	—	—	—	—	16	18
Georgia	74	75	—	—	—	—	9	5	—	—	—	—	83	80
Idaho	34	33	—	—	9	8	6	10	—	—	5	3	54	54
Iowa	39	29	11	5	—	—	—	—	—	—	—	—	50	34
La. Poly. Inst.	22	25	—	—	—	—	—	—	—	—	—	—	22	25
Louisiana State	37	31	—	—	—	—	—	—	—	—	—	—	37	31
Maine	26	35	—	—	—	—	9	11	—	—	—	—	35	46
Massachusetts	17	11	—	—	—	—	7	11	—	—	—	—	24	22
Michigan Mining	19	20	—	—	—	—	—	—	—	—	—	—	19	20
Michigan State	53	43	1	4	—	—	24	28	3	3	112	73	193	151
Michigan Univ.	20	26	6	3	—	—	14	6	—	—	3	1	43	36
Minnesota	45	56	2	3	—	—	—	—	—	—	3	4	50	63
Missouri	36	29	—	—	—	—	—	—	—	—	2	2	38	31
Montana	28	40	7	5	5	10	4	5	—	—	1	—	45	60
New Hampshire	11	7	—	—	—	—	4	3	—	—	—	—	15	10
New York	44	37	22	21	—	—	—	—	—	—	27	37	93	95
North Carolina	33	44	11	13	—	—	—	—	—	—	10	24	54	81
Oregon	59	72	11	8	—	—	—	—	—	—	—	—	70	80
Pennsylvania	49	65	11	2	—	—	—	—	—	—	4	2	64	69
Purdue	37	36	6	3	—	—	—	—	—	—	—	—	43	39
Utah	33	22	—	—	20	21	30	30	—	—	—	—	83	73
Washington	45	40	7	12	—	—	—	—	—	—	—	—	52	52
West Virginia	14	27	6	5	—	—	6	14	—	—	—	—	26	46
Total	868	893	105	92	43	61	136	137	14	9	170	147	1,336	1,340
Schools not accredited														
Arizona Univ.	—	—	—	—	4	4	—	—	—	—	—	—	4	4
Arkansas	16	12	—	—	—	—	—	—	—	—	—	—	16	12
Clemson	7	8	—	—	—	—	—	—	—	—	—	—	7	8
Connecticut	13	11	—	—	—	—	5	4	—	—	—	—	18	15
Humboldt	14	21	—	—	—	—	31	22	—	—	—	—	45	43
Illinois	—	2	—	—	—	—	—	—	—	—	—	—	—	2
Mississippi	24	30	—	—	—	—	—	—	—	—	—	—	24	30
Oklahoma	29	25	—	—	—	—	—	—	—	—	—	—	29	25
Rutgers	7	7	—	—	—	—	—	—	—	—	—	—	7	7
So. Illinois	—	5	—	—	—	—	—	—	—	—	—	—	—	5
Univ. of the South	4	5	—	—	—	—	—	—	—	—	—	—	4	5
Texas (S.F. Austin)	14	12	—	—	—	—	—	—	—	—	—	—	14	12
Virginia Poly. Inst.	4	5	—	—	—	—	—	—	—	—	—	—	4	5
Washington State	15	18	—	—	5	1	—	—	—	—	—	—	20	19
Total	147	161	—	—	9	5	36	26	—	—	—	—	192	192
Grand total	1,015	1,054	105	93	52	66	172	163	14	9	170	147	1,528	1,532

tion are slightly different from those listed last year.

The statistics on degrees granted and enrollment of graduate students were first broken down by specialized curricula in 1953. In 1954 this breakdown was extended to the enrollment of undergraduate students in the junior and senior classes. At that time it was found that there was little segregation during the first two years and a breakdown of the enrollment in those classes was virtually impossible.

The same five broad classes used for the past six years have been used again this year. These are *general forestry, wood technology and utilization, range management, wildlife management,* and *forest recreation.* Those curricula falling outside of these broad classes have been grouped under the heading *others.*

Each of these classes was described in 1954 (Jour. Forestry 52:354-358) and 1955 (Jour. Forestry 53:256-261), and again in 1958 (Jour. Forestry 56:129-135).

Degrees Granted

During the calendar year 1960 the 43 schools of forestry awarded an estimated 1,532 undergraduate degree, 365 master degrees, and 40 doctor degrees. Of the total undergraduate degrees 1,340 were awarded by the accredited schools, compared to 1,336 in 1959. In both years these figures represented 87 percent of the total.

Looking at the breakdown of the undergraduate degrees in the specialized fields, we find that 1,054 or 69 percent were in the field of *general forestry.* This compares to 69 percent in 1959 and 66 percent in 1957 and 1958 (Table 2). *Wildlife management* ranked second with 11 percent and *wood technology and utilization* followed with 6 percent, while *others* accounted for 10 percent.

TABLE 3.—MASTER DEGREES GRANTED FOR COMPLETION OF STUDIES IN SPECIALIZED FIELDS AT SCHOOLS OF FORESTRY IN THE UNITED STATES—CALENDAR YEARS 1959 AND 1960

	General forestry		Wood technology		Range management		Wildlife management		Forest recreation		Others		Totals	
	1959	1960	1959	1960	1959	1960	1959	1960	1959	1960	1959	1960	1959	1960
Accredited schools														
Alabama	—	1	—	—	—	—	—	—	—	—	—	—	—	1
California	12	7	—	—	—	1	—	—	—	—	—	—	12	8
Colorado	4	4	—	—	4	2	5	7	—	—	—	—	13	13
Duke	15	23	2	7	—	—	—	—	—	—	—	—	17	30
Florida	—	1	—	—	—	—	—	—	—	—	—	—	—	1
Georgia	4	3	—	—	—	—	—	3	—	—	—	—	4	6
Idaho	8	2	—	—	1	2	3	4	—	—	—	—	12	8
Iowa	—	2	—	—	—	—	—	—	—	—	—	—	—	2
Louisiana State	5	8	2	—	—	—	3	4	—	—	—	—	10	12
Maine	—	1	—	—	—	—	2	1	—	—	—	—	2	2
Massachusetts	—	—	—	—	—	—	2	3	—	—	—	—	2	3
Michigan State	6	4	—	—	—	—	9	9	—	—	13	13	28	26
Michigan Univ.	7	14	—	2	—	—	6	12	—	—	3	8	16	36
Minnesota	4	7	—	—	—	—	—	—	—	—	—	—	4	7
Missouri	1	4	—	—	—	—	—	—	—	—	—	—	1	4
Montana	3	11	—	—	1	1	1	1	—	—	—	1	5	14
New Hampshire	—	1	—	—	—	—	—	—	—	—	—	—	—	1
New York	17	18	14	8	—	—	3	4	—	4	6	—	40	34
North Carolina	3	3	3	4	—	—	—	—	—	—	—	—	6	7
Oregon	5	7	2	2	—	—	—	—	—	—	—	—	7	9
Pennsylvania	4	5	5	2	—	—	2	1	—	—	—	—	11	8
Purdue	2	6	—	—	—	—	—	—	—	—	3	1	5	7
Utah	4	4	—	—	—	2	5	9	—	—	—	—	9	15
Washington	4	8	2	—	—	—	—	—	—	—	—	—	6	8
Yale	29	33	2	4	—	—	—	—	—	—	—	—	31	37
Total	137	177	32	29	6	8	41	58	—	4	25	23	241	299
Schools not accredited														
Arizona Univ.	—	—	—	—	4	1	—	—	—	—	—	—	4	1
Connecticut	—	—	—	—	—	—	1	2	—	—	—	—	1	2
Humboldt	—	—	—	—	—	—	1	—	—	—	—	—	1	—
Va. Poly. Inst.	—	—	—	—	—	—	1	3	—	—	—	—	1	3
Total	—	—	—	—	4	1	3	5	—	—	—	—	7	6
Grand total	137	177	32	29	10	9	44	63	—	4	25	23	248	305

TABLE 4.—DOCTOR DEGREES GRANTED FOR COMPLETION OF STUDIES IN SPECIALIZED FIELDS AT SCHOOLS OF FORESTRY IN THE UNITED STATES—CALENDAR YEARS 1959 AND 1960

	General forestry		Wood technology		Range management		Wildlife management		Forest recreation		Others		Totals	
	1959	1960	1959	1960	1959	1960	1959	1960	1959	1960	1959	1960	1959	1960
Accredited schools														
California	1	3	—	—	—	—	—	—	—	—	—	—	1	3
Duke	2	2	—	—	—	—	—	—	—	—	—	—	2	2
Iowa	—	—	—	1	—	—	—	—	—	—	—	—	—	1
Michigan State	—	2	—	—	—	—	1	3	—	—	—	—	1	5
Michigan Univ.	5	5	1	—	—	—	4	4	—	—	3	—	13	9
Minnesota	1	3	—	—	—	—	—	—	—	—	—	—	1	3
New York	2	2	8	4	—	—	2	—	—	—	—	—	12	6
North Carolina	—	—	—	1	—	—	—	—	—	—	—	—	—	1
Purdue	—	1	—	—	—	—	—	—	—	—	—	—	—	1
Utah	—	—	—	—	2	2	1	—	—	—	—	—	3	2
Washington	1	—	—	—	—	—	—	—	—	—	—	—	1	—
Yale	5	2	3	2	—	—	—	—	—	—	—	—	8	4
Total	17	20	12	8	2	2	8	7	—	—	3	—	42	37
Schools not accredited														
Ariz. Univ.	—	—	—	—	—	2	—	—	—	—	—	—	—	2
Va. Poly. Inst.	—	—	—	—	—	—	—	1	—	—	—	—	—	1
Total	—	—	—	—	—	2	—	1	—	—	—	—	—	3
Grand total	17	20	12	8	2	4	8	8	—	—	3	—	42	40

TABLE 5.—ENROLLMENT BY CLASSES AT SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE FALL TERM 1960-1961

	Freshman	Sophomore	Junior	Senior	Total undergraduate	Graduate Master	Graduate Doctor	Total graduate
Accredited schools								
Alabama	108	43	39	22	212	4	—	4
California	11	23	39	42	115	26	44	70
Colorado	182	87	87	92	448	28	9	37
Duke	—	—	—	—	—	46	24	70
Florida	45	35	17	24	121	5	—	5
Georgia	43	55	97	119	314	14	—	14
Idaho	94	72	69	63	298	20	4	24
Iowa	78	41	47	56	222	7	1	8
La. Poly. Inst.	45	30	34	22	131	—	—	—
Louisiana State	49	20	15	30	114	21	—	21
Maine	82	52	46	52	232	6	—	6
Massachusetts	38	35	26	23	122	15	—	15
Michigan Mining	59	48	40	33	180	—	—	—
Michigan State	144	132	176	150	602	51	27	78
Michigan Univ.	24	24	44	63	155	38	45	83
Minnesota	101	90	82	60	333	20	15	35
Missouri	48	51	20	31	150	4	—	4
Montana	125	69	39	73	306	18	—	18
New Hampshire	23	17	13	12	65	6	—	6
New York	205	159	108	80	552	89	62	151
North Carolina	108	102	77	97	384	24	9	33
Oregon	84	81	84	79	328	18	7	25
Pennsylvania	108	75	70	81	334	23	—	23
Purdue	53	54	45	32	184	15	7	22
Utah	118	57	107	104	386	26	20	46
Washington	98	58	62	33	251	22	13	35
West Virginia	85	93	44	41	263	—	—	—
Yale	—	—	—	—	—	31	19	50
Total	2,158	1,603	1,527	1,514	6,802	577	306	883
Schools not accredited								
Arizona State	56	52	16	5	129	—	—	—
Arizona University	11	11	6	8	36	9	6	15
Arkansas	42	29	22	27	120	—	—	—
Clemson	73	52	23	18	166	—	—	—
Connecticut	18	16	13	13	60	3	—	3
Humboldt	85	80	71	60	296	7	—	7
Illinois	35	42	25	18	120	—	—	—
Mississippi	37	28	36	47	148	—	—	—
Oklahoma	29	31	34	38	132	—	—	—
Rutgers	10	11	11	8	40	—	—	—
Southern Illinois	39	26	28	14	107	—	—	—
Univ. of the South	14	7	5	7	33	—	—	—
Texas (S.F. Austin)	43	17	15	10	85	—	—	—
Va. Poly. Inst.	25	20	14	12	71	8	—	8
Washington State	31	23	20	20	94	—	—	—
Total	548	445	339	305	1,637	27	6	33
Grand total	2,706	2,048	1,866	1,819	8,439	604	312	916

TABLE 6.—UNDERGRADUATE FALL TERM ENROLLMENT BY CLASSES IN SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE YEARS 1944-1945 THROUGH 1960-1961

Academic years	—Freshman— Enrollment	Change	—Sophomore— Enrollment	Change	—Junior— Enrollment	Change	—Senior— Enrollment	Change	——Totals—— Enrollment	Change
1944-1945	321	+ 122	114	+ 20	64	— 37	72	— 37	571	+ 68
1945-1946	840	+ 519	315	+ 201	205	+141	113	+ 41	1,473	+ 902
1946-1947	3,611	+2,771	1,840	+1,525	914	+709	645	+532	7,010	+5,537
1947-1948	2,061	—1,550	2,878	+1,038	1,577	+663	938	+293	7,454	+ 444
1948-1949	1,851	— 210	2,178	— 700	2,497	+920	1,686	+748	8,212	+ 758
1949-1950	1,485	— 366	1,667	— 511	1,816	—681	2,501	+815	7,469	— 743
1950-1951	1,442	— 43	1,379	— 288	1,384	—432	1,730	—771	5,935	—1,534
1951-1952	1,370	— 72	1,107	— 272	1,053	—331	1,269	—461	4,799	—1,136
1952-1953	1,536	+ 166	1,012	— 95	1,013	— 40	1,130	—139	4,691	— 108
1953-1954	1,698	+ 162	1,168	+ 156	917	— 96	1,126	— 4	4,909	+ 218
1954-1955	1,986	+ 288	1,377	+ 209	1,032	+115	962	—164	5,357	+ 448
1955-1956	2,149	+ 163	1,566	+ 189	1,236	+204	1,087	+125	6,038	+ 681
1956-1957	2,220	+ 71	1,807	+ 241	1,549	+313	1,357	+270	6,933	+ 895
1957-1958	2,230	+ 10	1,831	+ 24	1,759	+210	1,575	+218	7,935	+ 462
1958-1959	2,516	+ 286	1,860	+ 29	1,718	— 41	1,772	+197	7,866	+ 471
1959-1960	2,569	+ 53	1,948	+ 88	1,774	+ 56	1,810	+ 38	8,101	+ 235
1960-1961	2,706	+ 137	2,048	+ 100	1,866	+ 92	1,819	+ 9	8,439	+ 338

TABLE 7.—ENROLLMENT OF JUNIOR AND SENIOR STUDENTS IN SPECIALIZED FIELDS AT SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE FALL TERM 1960-1961

	General forestry		Wood technology		Range management		Wildlife management		Forest recreation		Others		Totals	
	Jr.	Sr.	Jr.	Sr.	Jr.	Sr.	Jr.	Sr.	Jr.	Sr.	Jr.	Sr.	Jr.	Sr.
Accredited schools														
Alabama	35	18	4	4	...	...	...	...	...	...	...	...	39	22
California	39	42	...	...	...	3	...	...	...	...	...	...	39	45
Colorado	24	26	7	10	12	12	32	31	8	12	4	1	87	92
Florida	12	20	3	...	...	...	2	4	...	...	...	...	17	24
Georgia	88	108	...	...	...	...	9	11	...	...	...	...	97	119
Idaho	52	38	...	...	4	11	10	12	...	...	3	2	69	63
Iowa	33	45	14	11	...	...	...	...	...	...	...	...	47	56
La. Poly. Inst.	34	22	...	...	...	...	...	...	...	...	...	...	34	22
Louisiana State	15	30	...	...	...	...	...	...	...	...	...	...	15	30
Maine	37	46	...	...	...	...	9	6	...	...	...	...	46	52
Massachusetts	13	18	...	...	...	...	13	5	...	...	...	...	26	23
Michigan Mining	40	33	...	...	...	...	...	...	...	...	...	...	40	33
Michigan State	47	43	2	2	...	...	37	33	6	5	84	67	176	150
Michigan Univ.	24	30	9	6	...	...	9	19	...	...	2	8	44	63
Minnesota	76	51	1	3	...	...	...	...	...	...	5	6	82	60
Missouri	17	27	...	...	...	...	...	...	...	...	3	4	20	31
Montana	27	46	5	3	3	13	1	7	2	...	1	4	39	73
New Hampshire	8	11	...	...	...	...	5	1	...	...	...	...	13	12
New York	57	32	15	15	...	...	...	...	...	...	36	33	108	80
North Carolina	49	66	3	7	...	...	...	...	...	...	25	24	77	97
Oregon	76	67	8	12	...	...	...	...	...	...	...	...	84	79
Pennsylvania	63	68	5	9	...	...	...	...	...	...	2	4	70	81
Purdue	38	27	4	...	...	...	3	5	...	...	...	...	45	32
Utah	30	30	...	...	29	34	39	35	9	5	...	...	107	104
Washington	49	25	13	8	...	...	...	...	...	...	...	...	62	33
West Virginia	28	31	9	5	...	...	7	5	...	...	...	...	44	41
Total	1,011	1,000	102	95	48	73	176	174	25	22	165	153	1,527	1,517
Schools not accredited														
Arizona State	16	5	...	...	...	...	...	...	...	...	...	...	16	5
Arizona Univ.	...	1	...	...	6	6	...	...	...	1	...	...	6	8
Arkansas	22	27	...	...	...	...	...	...	...	...	...	...	22	27
Clemson	23	18	...	...	...	...	...	...	...	...	...	...	23	18
Connecticut	11	7	...	...	...	...	2	6	...	...	...	...	13	13
Humboldt	41	35	...	...	...	...	30	25	...	...	...	...	71	60
Illinois Univ.	20	18	5	...	...	...	...	...	...	...	...	...	25	18
Mississippi	36	47	...	...	...	...	...	...	...	...	...	...	36	47
Oklahoma	34	38	...	...	...	...	...	...	...	...	...	...	34	38
Rutgers	11	8	...	...	...	...	...	...	...	...	...	...	11	8
So. Illinois	28	14	...	...	...	...	...	...	...	...	...	...	28	14
Univ. of the South	5	7	...	...	...	...	...	...	...	...	...	...	5	7
Texas (S.F. Austin)	15	10	...	...	...	...	...	...	...	...	...	...	15	10
Va. Poly. Inst.	14	11	...	...	...	...	...	1	...	...	...	...	14	12
Washington State	17	13	...	...	3	7	...	...	...	...	...	...	20	20
Total	293	259	5	...	9	13	32	32	...	1	...	...	339	305
Grand total	1,304	1,259	107	95	57	86	208	206	25	23	165	153	1,866	1,822

TABLE 8.—FALL TERM ENROLLMENT OF WOMEN IN SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE YEARS 1943 THROUGH 1960

	Freshman	Sophomore	Junior	Senior	Total undergraduates	—Graduates— Master	Doctor
1943	2	..	1	4	7	..	..
1944	5	5	..	1	11	1	..
1945	5	6	5	..	16	1	..
1946	5	5	4	4	18	..	1
1947	1	1	3	4	9	..	..
1948	1	3	1	4	9	2	..
1949	1	1	2	2	6	1	..
1950	2	..	1	4	7	1	1
1951	..	4	..	1	5	..	1
1952	5	2	3	..	10	1	1
1953	8	5	..	3	16	..	..
1954	7	6	3	1	17	2	..
1955	4	5	6	3	18	5	1
1956	8	3	5	4	20	4	5
1957	7	4	5	4	20	4	1
1958	9	7	1	4	21	6	3
1959	6	4	2	4	16	8	..
1960	11	8	4	1	24	6	..

The estimated number of master degrees granted in 1960 totaled 305. *General forestry* accounted for 177 or 58 percent. *Wildlife management* ranked second with 63 or 21 percent and *wood technology and utilization* third with 29 or 9 percent. Of the 305 master degrees granted 299 were granted by the accredited schools (Table 3).

The estimated number of doctor degrees granted this year decreased to 40 from 42 in 1959. The largest number, 20 (50 percent), were in *general forestry* (Table 4).

Undergraduate Enrollment

After an all-time high of 8,212

TABLE 9.—ENROLLMENT OF GRADUATE STUDENTS IN SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE FALL TERM 1960-1961

	General forestry		Wood technology		Range management		Wildlife management		Forest recreation		Others		Totals	
	Ms.	Dr.	Ms.	Dr.	Ms.	Dr.	Ms.	Dr.	Ms.	Dr.	Ms.	Dr.	Ms.	Dr.
Accredited schools														
Alabama	2	—	2	—	—	—	—	—	—	—	—	—	4	—
California	15	37	7	1	2	3	—	—	—	—	2	3	26	44
Colorado	4	—	—	—	5	—	8	3	2	—	9	6	28	9
Duke	38	22	8	2	—	—	—	—	—	—	—	—	46	24
Florida	3	—	—	—	—	—	2	—	—	—	—	—	5	—
Georgia	12	—	2	—	—	—	—	—	—	—	—	—	14	—
Idaho	11	2	—	—	3	1	4	1	—	—	2	—	20	4
Iowa	5	—	2	1	—	—	—	—	—	—	—	—	7	1
Louisiana State	6	—	7	—	—	—	8	—	—	—	—	—	21	—
Maine	2	—	—	—	—	—	4	—	—	—	—	—	6	—
Massachusetts	4	—	—	—	—	—	11	—	—	—	—	—	15	—
Michigan State	11	13	—	—	—	—	18	11	—	—	22	3	51	27
Michigan Univ.	21	18	2	—	—	—	10	16	—	—	5	11	38	45
Minnesota	12	14	7	1	—	—	—	—	—	—	1	—	20	15
Missouri	4	—	—	—	—	—	—	—	—	—	—	—	4	—
Montana	14	—	—	—	1	—	3	—	—	—	—	—	18	—
New Hampshire	6	—	—	—	—	—	—	—	—	—	—	—	6	—
New York	45	11	23	44	—	—	3	4	—	—	18	3	89	62
North Carolina	17	4	7	5	—	—	—	—	—	—	—	—	24	9
Oregon	17	7	1	—	—	—	—	—	—	—	—	—	18	7
Pennsylvania	18	—	1	—	—	—	4	—	—	—	—	—	23	—
Purdue	8	1	2	1	—	—	1	5	—	—	4	—	15	7
Utah	8	—	—	—	6	7	12	13	—	—	—	—	26	20
Washington	15	11	7	2	—	—	—	—	—	—	—	—	22	13
Yale	25	17	6	2	—	—	—	—	—	—	—	—	31	19
Total	323	157	84	59	17	11	88	53	2	—	63	26	577	306
Schools not accredited														
Arizona Univ.	5	—	—	—	4	6	—	—	—	—	—	—	9	6
Connecticut	—	—	—	—	—	—	3	—	—	—	—	—	3	—
Humboldt	—	—	—	—	—	—	7	—	—	—	—	—	7	—
Va. Poly. Inst.	—	—	—	—	—	—	8	—	—	—	—	—	8	—
Total	5	—	—	—	4	6	18	—	—	—	—	—	27	6
Grand total	328	157	84	59	21	17	106	53	2	—	63	26	604	312

in the fall of 1948, undergraduate enrollment dropped to 4,691 in 1952. Since then it has increased each year and this year reached a new high of 8,439 (227 above 1948). Not only is there a new high in enrollment, but also a new high in the number of institutions represented. In 1948 there were only 34 schools (22 accredited and 12 non-accredited), while today the accredited schools have increased to 28 and the non-accredited to 15 or a total of 43 (Tables 5 and 6).

While all classes show an increase in enrollment this year totaling 338 or 4.2 percent, the senior class has an increase of only 9.

Looking at the breakdown by specialized curricula we find that 70 percent of the junior and 69 percent of the senior enrollment were accounted for by those majoring in *general forestry* (Table 7). These percentages are approximately the same as they have been

TABLE 10.—NUMBER OF DEGREES GRANTED FOR COMPLETION OF STUDIES AT SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE CALENDAR YEARS 1900-1960

Years	Undergraduate degrees	Master degrees	Doctor degrees
1900	1	—	
1901	5	—	
1902	2	9	
1903	3	14	
1904	9	29	
1905	9	34	
1906	24	24	
1907	19	27	
1908	31	35	
1909	47	44	
1910	61	48	
1911	100	61	
1912	122	54	
1913	136	37	
1914	151	42	
1915	124	35	
1916	151	36	
1917	160	27	
1918	65	10	
1919	53	6	
1920	160	25	
1921	126	26	
1922	141	44	
1923	217	31	
1924	215	43	
1925	280	44	
1926	259	58	
1927	263	50	
1928	302	64	
1929	291	54	
1930	308	69	
1931	394	97	(34)[1]
1932	380	78	7
1933	355	65	6
1934	337	47	6
1935	423	58	8
1936	502	67	9
1937	803	75	7
1938	980	95	5
1939	1,102	112	8
1940	1,072	105	9
1941	834	117	12
1942	654	76	13
1943	446	28	6
1944	106	12	3
1945	51	18	7
1946	192	65	8
1947	553	223	7
1948	918	222	16
1949	1,443	205	12
1950	2,321	275	29
1951	1,564	267	21
1952	1,267	226	25
1953	1,045	151	37
1954	957	179	44
1955	829	194	31
1956	887	233	34
1957	1,172	207	48
1958	1,362	224	41
1959	1,528	248	42
1960	1,532	305	40
Total	29,844	5,344	575

[1]Total doctor degrees granted prior to 1932. Breakdown by years not available.

for the past several years. In other words, over two-thirds of the undergraduate enrollment continues to be in *general forestry* (Table 7). It would also indicate that the bachelor degrees granted during the next two years will continue to account for at least two-thirds of the total.

Wildlife management ranks second, as it did last year, with 11 percent of the junior and senior classes. *Wood technology and utilization* follows with 5 percent and *range management* with 4 percent.

Trends in enrollment are always confused by many factors, and predictions are hazardous at best. Five years ago trends indicated an increase in 1956 of 10 percent which actually totaled 15 percent. The trends for 1957 indicated an increase of 12 percent, but showed an increase of only 7 percent. The trends for 1958 indicated a net increase of 3 percent, but the actual increase was 6½ percent.

In 1958 I predicted that if present trends continued, the undergraduate enrollment in the fall of 1959 should approach the 1948 all-time high of 8,212. This it did with an enrollment of 8,101. Last year's predictions were that there would be only a slight increase this year; however, this increase totaled 338 or 103 more than last year. With the over-all increase in student enrollments and with the increased importance of all phases of forestry, forestry school enrollments should continue to rise.

The enrollment of undergraduate women, while continuing small, is the largest since records were begun in 1943 and totals 24. The freshman class with 11 is the largest of any class on record (Table 8).

Graduate Enrollment

The graduate enrollment is confined to 25 accredited and 4 non-accredited schools. The enrollment for the master degree has decreased from 609 to 604, and the doctorate increased from 247 to 312, or a total net increase from 856 to 916. Of these, 53 percent are in *general forestry;* 17 percent in *wildlife management;* 16 percent *in wood technology and utilization;* and 4 percent in *range management.*

The accredited schools account for 577 of the 604 master candidates and 306 of the 312 doctor candidates. Among the accredited schools 323 of the 577 master candidates were enrolled in *general forestry,* 88 in *wildlife management,* 84 in *wood technology and utilization,* and 17 in *range management.* Among the non-accredited schools out of a total of 27 candidates, 18 were in *wildlife management,* 5 in *general forestry,* and 4 in *range management* (Table 9).

The enrollment for the doctorate in the accredited schools shows 157 in *general forestry,* 59 in *wood technology and utilization,* 53 in *wildlife management,* and 11 in *range management* (Table 9).

Of the 916 graduate students enrolled throughout the nation only six are women, all of whom are candidates for the master degree (Table 8).

Division of Silviculture Call for Annual Meeting Papers

The 1961 Annual Meeting of the Society of American Foresters will include a Technical Session on Silviculture to be held on Wednesday, October 11, in Minneapolis, Minn. There will be morning and afternoon sessions held jointly with members of the Canadian Institute of Forestry having similar interests.

Correspondence relating to the Technical Sessions on Silviculture should be addressed to Paul O. Rudolf, Chairman, SAF Division of Silviculture, Lake States Forest Experiment Station, St. Paul Campus, University of Minnesota, St. Paul 1, Minn. Society members wishing to present papers should submit, in triplicate, the following information: (1) Title, (2) short abstract, (3) name and address of the author, (4) name and address of the organization represented, (5) time required for presentation, and (6) type of projection equipment required. To be considered, this information must be received before May 15, 1961.

The SAF portion of the program will be made up by the executive committee of the Division of Silviculture by selecting papers from proposals submitted. Presentations requiring 15 minutes or less are favored, and none will be considered that require more than 20 minutes.

Authors of selected papers will be notified by June 15.

This is the only call for papers that will be issued by the Division of Silviculture.

Walter L. Beers, Jr.
Secretary, SAF Division of Silviculture,
The Buckeye Cellulose Corporation,
Foley, Fla.

A Study of Christmas Tree Prices in the St. Paul—Minneapolis Market[1]

Edward T. Sullivan

A SURVEY of the retail asking prices for Christmas trees in the 1956 market in the cities of St. Paul-Minneapolis, Minnesota, revealed certain price differences between tree species, heights, and grades. A knowledge of these differences should be of value to Christmas tree growers in comparing costs of cultural operations intended to upgrade trees with potential additional returns resulting from such practices. Returns from taller trees can be compared with the cost of holding them until they reach the greater height. Finally, variations in production costs between species can be compared with varying returns for different species.

Analogous price variations with height and grade revealed in a study by James[2] suggest that the general conclusions of this study are not confined to the St. Paul-Minneapolis Christmas tree market. Investigations of price variation by species, height, and grade should be conducted in other market areas.

Study Method

The cities and their suburbs were divided into four rectangular geographic quadrants, and each quadrant subdivided into 36 rectangular segments, all quadrants and segments having the same map dimensions. To prevent concentration of sample segments in a particular portion of the area studied, the quadrants were numbered at random. Following this random numerical order of quadrants, one segment was selected at random in each quadrant in turn. This procedure was repeated until segments containing 65 lots had been selected.

At each lot a random start, systematic sample of trees was made. Species, height, grade, and asking price, the last when obtainable, were determined for each sample tree. An attempt was made to secure a sample of 50 trees per lot (all trees if there were less than 50 on the lot), but this goal was reduced in a number of cases by the refusal of some lot owners to take the time to price trees which did not have price tags. The grading system used was that given by Barraclough and Phipps.[3]

It was possible to obtain asking prices for 763 of the 2,130 trees that were graded and measured. It was necessary to use asking price as a measure of tree price because only a minority of the lot owners price-tagged trees; most lot owners preferred to set an oral price for the customer. Although little explicit recognition was given to grades by such measures as segregating the different quality trees on the lot, the price differences between grades revealed in this study showed that lot operators were fully aware of grade distinctions.

Balsam Fir Prices

In Figure 1 average prices by height classes are plotted for the four grades of balsam fir. It is immediately apparent that there are substantial price differences between the premium and standard grades and between the standard grade and the lower grades. Differences between utility and cull grades are not evident.

Less apparent in Figure 1 are the differing rates between species with which prices change with height. These changes average \$0.66 per foot for premium grade; \$0.37 for standard; \$0.11 for utility; and \$0.04 for cull; all on a straight line basis.[4]

Norway Pine Prices

In Figure 2 average prices by height classes are plotted for three grades of Norway pine: premium, standard, and utility. Insufficient prices were obtained for cull trees to permit averaging data.

As with balsam fir, there are substantial price differences between grades for Norway pine.

The increase in price with the increase in height of tree is also different between grades. For each additional foot in height the increment in price is \$0.89 for premium grade; \$0.61 for standard grade;

THE AUTHOR is associate professor of forest economics, School of Forestry, University of Florida, Gainesville. This study was conducted while he was on the faculty of the School of Forestry, University of Minnesota, St. Paul.

[1]Paper No. 4293, Scientific Journal Series, Minnesota Agric. Expt. Sta. This work was supported in part by funds provided by the North Central Regional Technical Committee on the Marketing of Christmas Trees (NCM20).

[2]James, L. M. Resurvey of Christmas tree marketing in Michigan. Special Bulletin 419. Michigan State University, East Lansing. 1957.

[3]Barraclough, K. E., and R. K. Phipps. Christmas trees—a cash crop. Extension Bulletin 123. University of New Hampshire, Durham. 1954.

[4]Equations of price on height were derived for the different grades of balsam fir: Premium grade $Y=-1.002+0.656\,X_1$; Standard grade $Y=-4.545+1.598X_1 -0.077\,X_2$; Utility grade $Y= 1.128+0.107X_1$; Cull Grade $Y= 1.326+0.037X_1$. In these equations Y = price of the tree; X_1 = height of tree in feet; and X_2 (height of tree in feet)^2. Analysis of covariance showed differences significant at 1 percent between means and slopes. Analysis of variance showed a significant (at the 1 percent level) reduction in mean square in the standard grade resulting from the addition of the polynomial term to the regression equation. Price change with height for standard grade trees has been expressed on a straight line basis in the body of this paper for the purpose of simplicity.

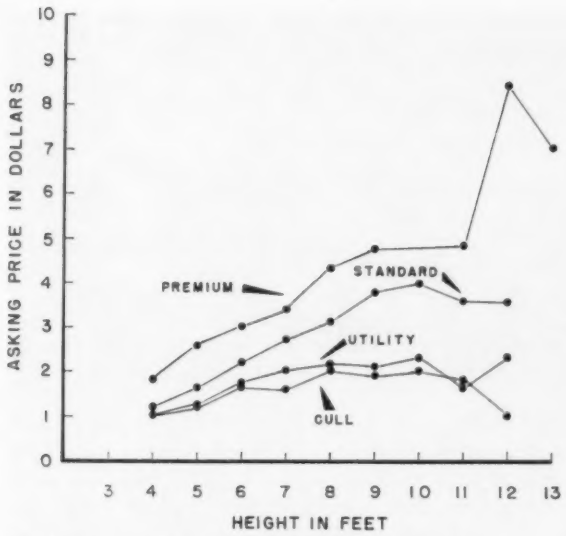


Fig. 1.—Balsam fir—average prices by height classes.

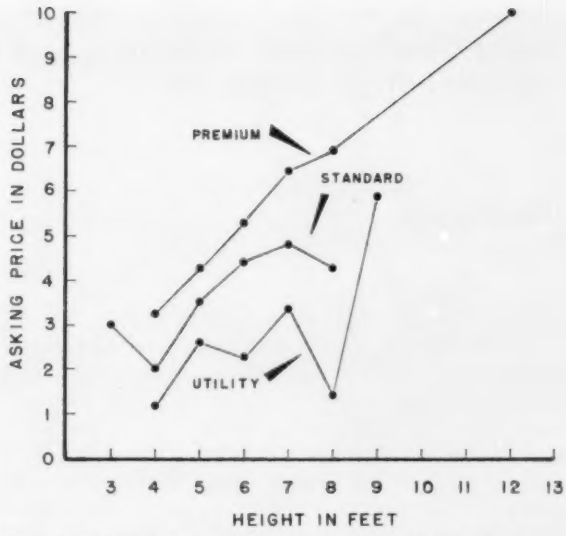


Fig. 2.—Norway pine—average prices by height classes.

Table 1.—Asking Prices for Eight-Foot Christmas Trees[1]

Grade	Balsam	Norway pine	Spruce
Premium	$4.25	$7.06	$4.16
Standard	3.30	5.10	2.25
Utility	1.99	3.41	1.78
Cull	1.63	[2]	1.45

[1]Calculated from equations in footnotes 4, 5, and 6. Additional relationships between prices, grades, and species can be developed through the use of these regressions.
[2]No price data were available for cull Norway pine.

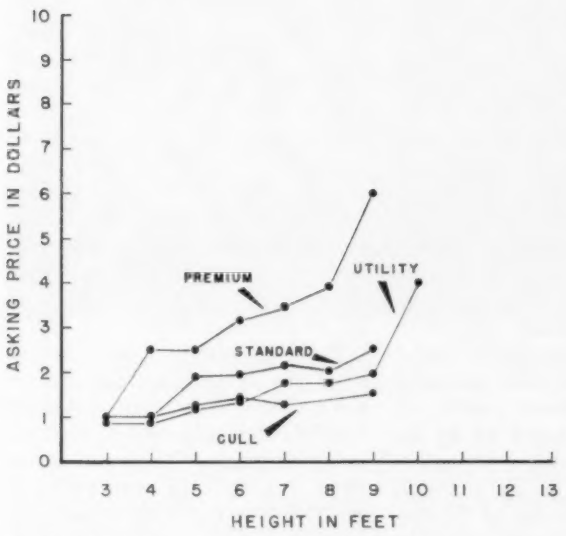


Fig. 3.—Spruce—average prices by height classes.

and $0.42 for utility grade trees.[5]

Spruce Prices

In Figure 3 average prices are plotted over height classes for each of four grades of spruce (black and white) Christmas trees. The price differential between premium grade trees and trees of the other grades is obvious, although differences in price between the standard, utility, and cull grades are not great.

Although the increase in price with the increase in height of tree is different between grades, this difference is not statistically significant. For each additional foot in height the increment in price is $0.60 for premium grade; $0.23 for standard grade; $0.18 for utility grade; and $0.07 for cull trees.[6]

Comparative Prices

Using the regression equations shown in footnotes 2, 3, and 4, it is possible to calculate orderly price series by height class and grade for the three species studied. This has been done in Table 1 for eight-foot trees. If care is taken not to go beyond the limits of the data included in the charts, similar price comparisons can be made for other tree heights, grades and species.

[5]Regression equations of price on height were derived for three grades of Norway pine:

Premium grade $Y=-0.06+0.89X$
Standard grade $Y=0.22+0.61X$
Utility grade $Y=0.05+0.42X$

In these equations Y = price of tree and X = height of tree in feet. Analysis of covariance indicated differences significant at 1 percent between means and at 5 percent between slopes.

[6]Regression equations of price on height were derived for four grades of spruce:

Premium grade $Y=-0.64+0.60X$
Standard grade $Y=0.41+0.23X$
Utility grade $Y=0.34+0.18X$
Cull $Y=0.89+0.07X$

In these equations Y = price of tree and X = height of tree in feet. Analysis of covariance indicated that the difference between slopes was not significant; difference between means was significant at the 10 percent level.

Weed Control, Soil Moisture, and Loblolly Pine Seedling Behavior

John J. Stransky

WHILE precipitation in east Texas is adequate (40 to 50 inches normally) for maintaining established forest trees, droughts are so common that pine seedlings, whether natural or planted, suffer very heavy mortality in their first year.

In previous experiments with planted pine seedlings the best survival was obtained on plots where competing weeds had been removed, together with the upper three or four inches of surface soil.[1] A tendency toward chlorosis and stunting in seedlings on such sites, which was absent when pine mulch was applied to the scalped surface, suggested nutrient deficiency due to topsoil removal.

The present study was initiated[2] in January 1958 to learn more about the relations of loblolly pine (*Pinus taeda* L.) seedlings to modified environments. In addition to the previously tested scalping and mulch applications, the study included herbicidal treatments intended to control competing weeds without loss of topsoil.

The Study

Soil of the study area is Cahaba fine sandy loam. Vegetative cover consists chiefly of partridge pea (*Cassia fasciculata* Michx.), ragweed (*Ambrosia trifida* L.), Bermuda grass (*Cynodon dactylon* [L.] Pers.), and goatweed (*Croton capitatus* Michx.).

In January 1958, the area was mowed and raked; then 20- by 20-foot plots were laid out, separated by four-foot walks.

Six treatments were tested in a randomized block design with three replications: (1) natural, i.e., control, (2) natural with pine-needle mulch, (3) Vapam—the soil sterilant sodium methyl dithiocarbamate, 32 percent, (4) Vapam with pine-needle mulch, (5) scalping, and (6) scalping with pine-needle mulch.

The soil sterilant was applied from a tractor-operated sprayer on January 27 at the rate of one quart of the proprietary formulation per 100 square feet of area. The amount of water (0.22 inch) applied with the chemical was deemed sufficient to move it down 4 to 5 inches, as the soil was at or near field capacity before being treated. Vapam almost completely eliminated partridge pea; its growing space, however, was promptly occupied by a dense growth of Bermuda grass, topped by an occasional ragweed and goatweed.

Scalping, done on February 7, removed about 3 inches of the surface soil. Two subsequent weedings sufficed to remove encroaching Bermuda grass and root suckers of *Rubus* from both the mulched and unmulched scalped plots.

Graded 1-0 seedlings were planted on February 28, 1958. Planting was done with bars, at a 2- by 2-foot spacing (100 plants per plot).

Mulching commenced on April 15 and was completed on May 1. On the natural-mulch plots the pine needles retarded weed and grass growth till midsummer; thereafter Bermuda grass emerged through the mulch and subsequently formed a dense growth. Vapam-mulch successfully inhibited weed growth and permitted only a very sparse growth of Bermuda and an occasional broad-leaved weed (Fig. 1).

Survivals and heights to terminal bud of the 36 centrally located seedlings in each plot were measured on April 9. June 25, September 4, and November 21, 1958. In December 1958, five randomly selected seedlings from each plot were cut at ground level and their dry weights determined after oven-drying for 24 hours at 105 C. Green diameters of these five seedlings were measured one inch above ground level.

Soil moisture was determined gravimetrically from King tube samples collected 10 times between June 5 and August 14, 1958. Samples were taken from these randomly selected points in each plot at 0- to 3-, 3- to 6-, 6- to 12-, and 12- to 18-inch depths.

Data on survival and height after one growing season, and on soil moisture as determined August 7, 1958, were subjected to variance analyses. August 7 was chosen because it marked the culmination of the moisture depletion apparently associated with most of the seedling mortality.

Rainfall during 1958 totaled 44.72 inches, about 2 inches below normal. Sizable deficiencies in February, March, May, July, and the three fall months were largely offset by excesses in April, June, August, and September.

A rainless period beginning May 10, after 2.44 inches of rainfall early in the month, continued to June 15 for a total of 36 days. After heavy rains (7.63 inches) in June and early July, a second drought began July 7 and extended, with only a 0.03-inch break on August 3, for 35 days, accompanied by the high temperatures normal for this season.

THE AUTHOR is a member of the Southern Forest Expt. Sta., Forest Service, U. S. Dept. Agric. He is assigned to the Nacogdoches Research Center, which is maintained in cooperation with Stephen F. Austin State College, Nacogdoches, Texas.

[1]Ferguson, E. R. Causes of first-year mortality of planted loblolly pines in east Texas. Soc. Amer. Foresters Proc. 1956: 89-92. Illus. 1957.

[2]It was designed and installed by Dr. Paul T. Koshi.

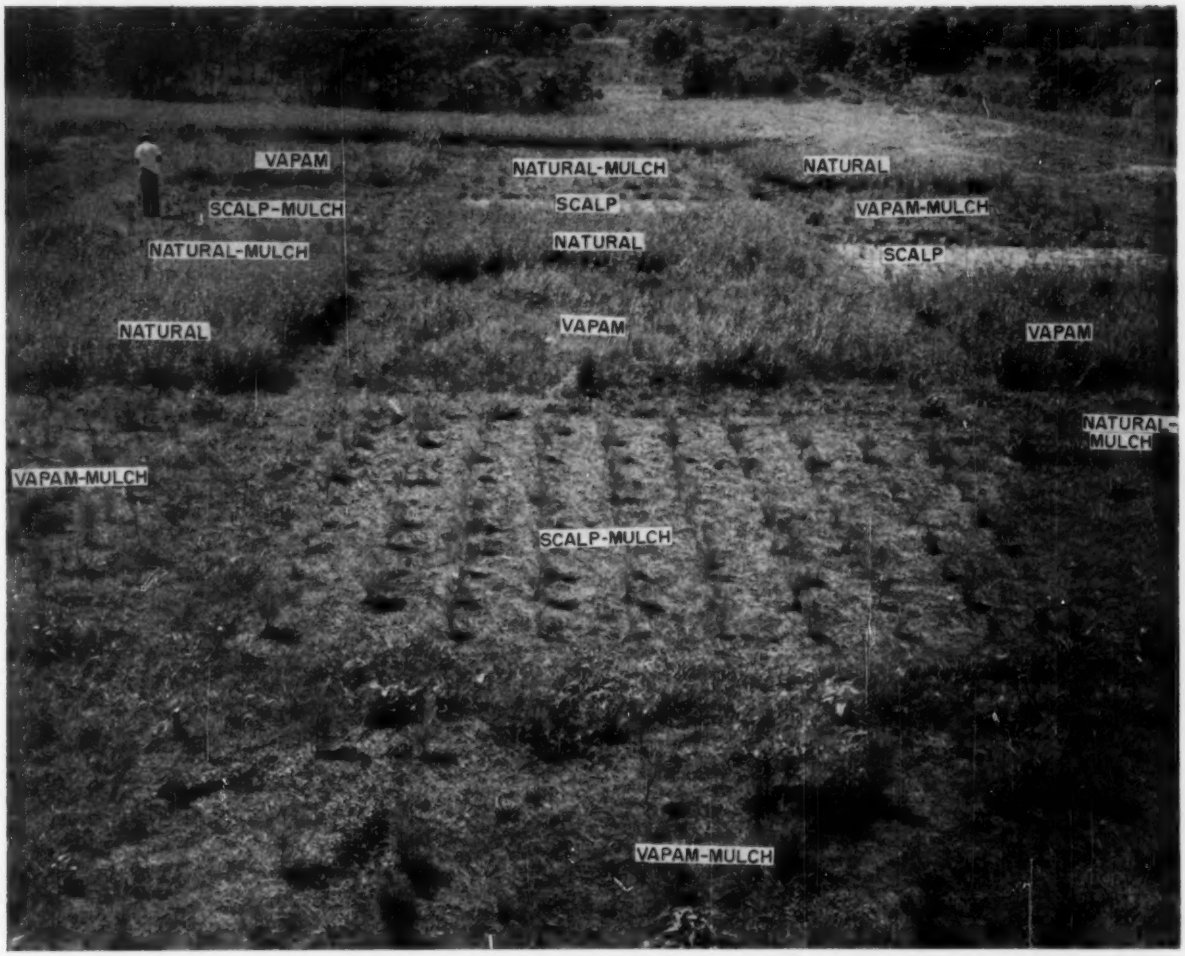


Fig. 1.—Part of test area in July; a scalped plot on the left and a scalp-mulch plot on the right of the plot in the foreground are not shown. Four-foot paths between plots were mowed periodically. Planted seedlings on several plots are obscured by competing vegetation.

The early spring deficiency did not seriously deplete soil moisture. The fall deficits likewise had little effect on the vegetation involved in this study.

Results and Discussion

Treatments that removed topsoil presumably also reduced available nutrients, since organic matter was concentrated largely in the surface layer. The mulch, in addition to smothering competition, increased infiltration and possibly added some nutrients.

The most potent effect of the treatments, however, was to increase the soil moisture available to the seedlings during the July-August drought, which accounted for most of the seedling mortality.

Soil moisture.—Generally, when moisture contents were high, differences among the various treatments were slight. In droughts, however, differences were pronounced, especially at the lower depths (Table 1).

On June 5, after 27 rainless days, mulched plots had much higher moisture content than unmulched ones (Fig. 2). As the mulches had suppressed weeds up to this time, the high moisture content of mulched plots may have resulted from lower evapo-transpiration. It is probable, too, that these plots entered the dry-down

Table 1.—Soil-moisture Contents at Time of Greatest Measured Soil-moisture Stress (August 7, 1958)

Treatment	Soil layer				
	0- to 3-inch	3- to 6-inch	6- to 12-inch	12- to 18-inch	0- to 18-inch
	Inches				
Not mulched					
Natural	0.07	0.11	0.40	0.59	1.17
Vapam	.05	.07	.32	.48	.92
Scalp	.05	.12	.62	.92	1.71
Mulched					
Natural	.07	.08	.36	.59	1.10
Vapam	.18	.17	.59	.91	1.85
Scalp	.22	.27	.80	1.15	2.44
Average by layer	.10	.14	.52	.77	1.53

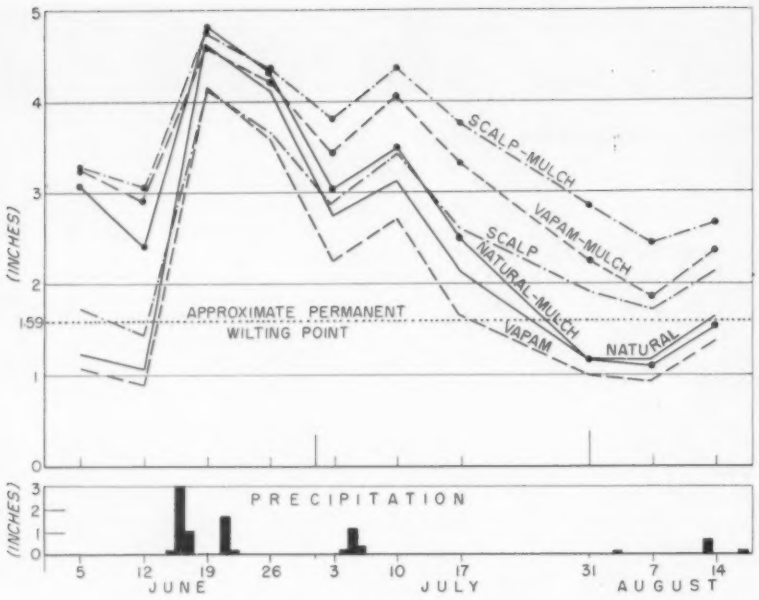


FIG. 2.—Total soil moisture in 0- to 18-inch profile.

period at higher moisture levels, since there were indications that mulch increased the proportion of rainfall entering the soil.

After late June, the natural-mulch plots lost relatively more water, and the scalped plots less, than others in their respective groups. By August the scalped plots had nearly as much water as the best mulched plots, while the natural-mulch plots were more comparable to those of the other two unmulched treatments.

On August 7, the mulched plots averaged more moisture in all horizons than the unmulched plots (Tables 1 and 2), the differences being highly significant. Vapam-mulch and scalp-mulch averaged more moisture than the natural mulch (highly significant at all soil depths except 0-3, which was significant), while scalp-mulch plots held more moisture than Vapam-mulch (significant except at 0-3 depth). These moisture levels are consistent with, and apparently result from, the influence of treatments on plot vegetation: residual soil moisture tended to be highest where vegetation was least abundant.

Among the unmulched plots, those that had been scalped retained more moisture than untreated or Vapam-treated plots. Differences below the 6-inch depth were highly significant, while differences from 0-6 inches were slight and nonsignificant. Here again moisture levels reflect vegetation differences resulting from treatment, the heavy grass stand on the Vapam plots apparently being closely equivalent to the natural grass-weed mixture in ability to extract moisture from the soil.

The higher moisture levels in August on scalp-mulch and Vapam-mulch plots are consistent with the relative condition of these treatments in early June, and may be a residual effect of higher early season moisture levels.

TABLE 2.—SIGNIFICANCE OF SOIL-MOISTURE VALUES OF AUGUST 7, 1958

Comparison	Soil layer				
	0- to 3-inch	3- to 6-inch	6- to 12-inch	12- to 18-inch	0- to 18-inch
Mulch versus no mulch	**	**	**	**	**
Natural-mulch versus Vapam-mulch and scalp-mulch	*	**	**	**	**
Vapam-mulch versus scalp-mulch	NS	*	**	*	*
Vapam versus scalp	NS	NS	**	**	**
Natural versus Vapam and scalp	NS	NS	NS	NS	NS

** Significant at 1-percent level.
* Significant at 5-percent level.
NS Not significant.

Effects on Seedlings

Ten months after planting, seedling survival percentages ranked as follows: scalp 92; scalp-mulch 90; Vapam-mulch 83; natural-mulch 70; Vapam 57; and natural 30 (Fig. 3).

About 2 percent of all mortality was attributable to planting shock, and about 2.4 percent to damage by rabbits and gophers. All other mortality appeared to be related to droughts (Table 3), notably to the one in July and August.

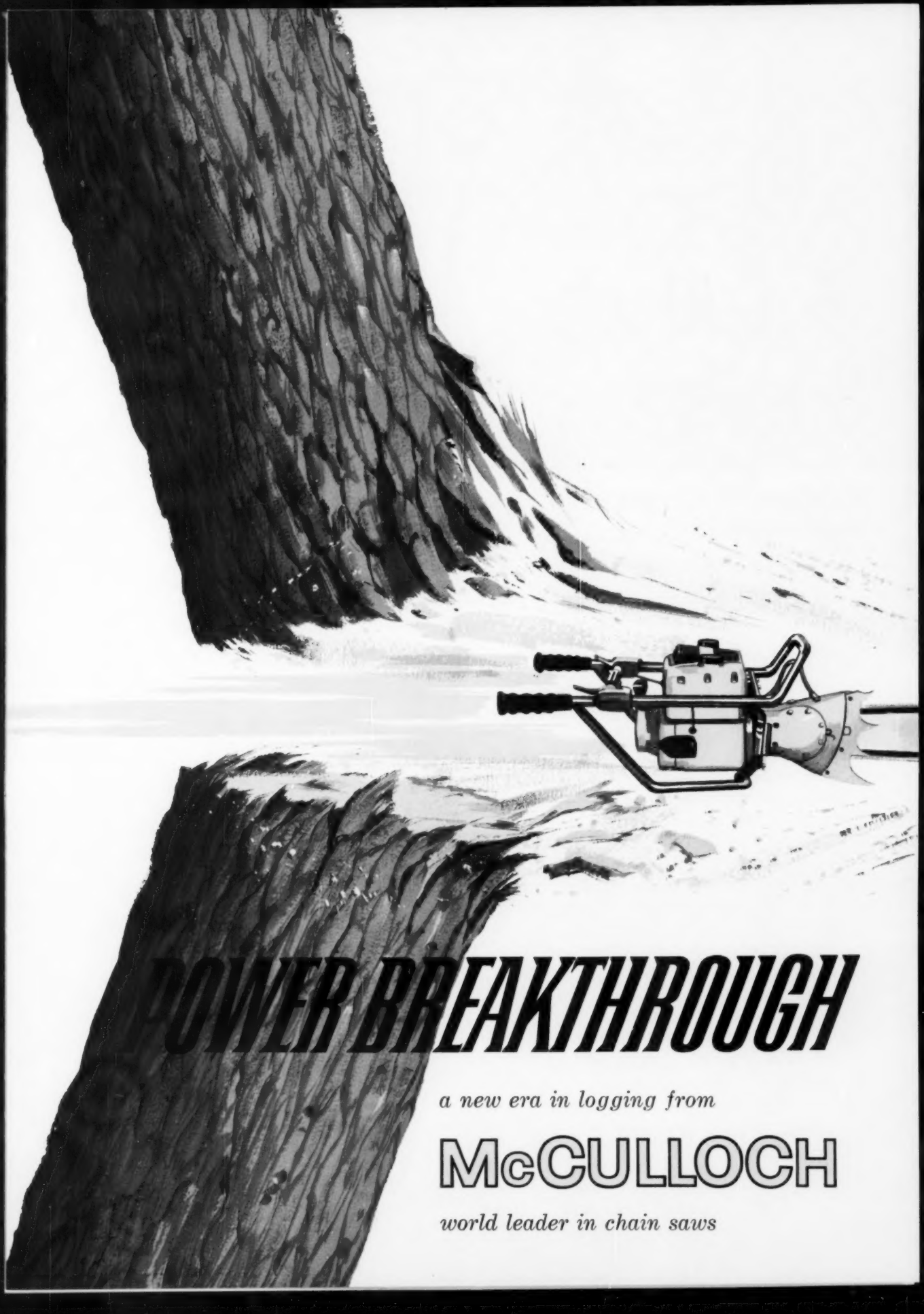
Final survival on the mulched plots was significantly superior to that on unmulched plots. The differences between mulched plots were not significant.

Among the unmulched treatments, survival on natural plots was very significantly lower than for the average of Vapam and scalp, while on Vapam plots it was significantly lower than on scalped. Though moisture was scant under Vapam treatment, survival was still higher than on natural plots. This result may be due to a less severe competition for light by the low grass cover on Vapam plots, as compared with the dense broadleaf weeds that completely overtopped seedlings on the natural plots.

Average heights after one growing season varied from 1.05 to 1.13 feet for non-mulched treatments, and from 1.34 to 2.12 feet for mulched (Fig. 4). The difference between the two groups, which was highly significant, became established as early as June 20.

With mulch, the Vapam and scalped plots produced very significantly better height growth than the natural plots, and seedlings on Vapam-mulch plots were significantly taller than those on scalp-mulch plots. Without mulch no height differences were significant.

(Continued on page 289)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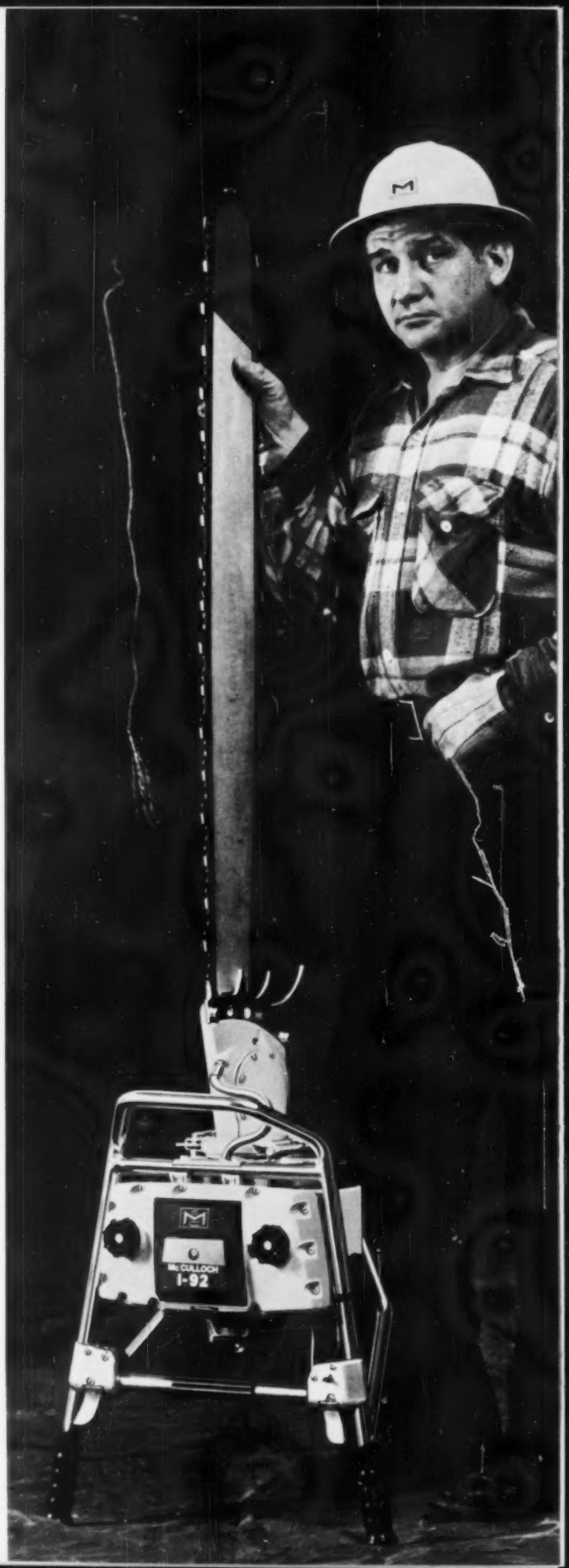

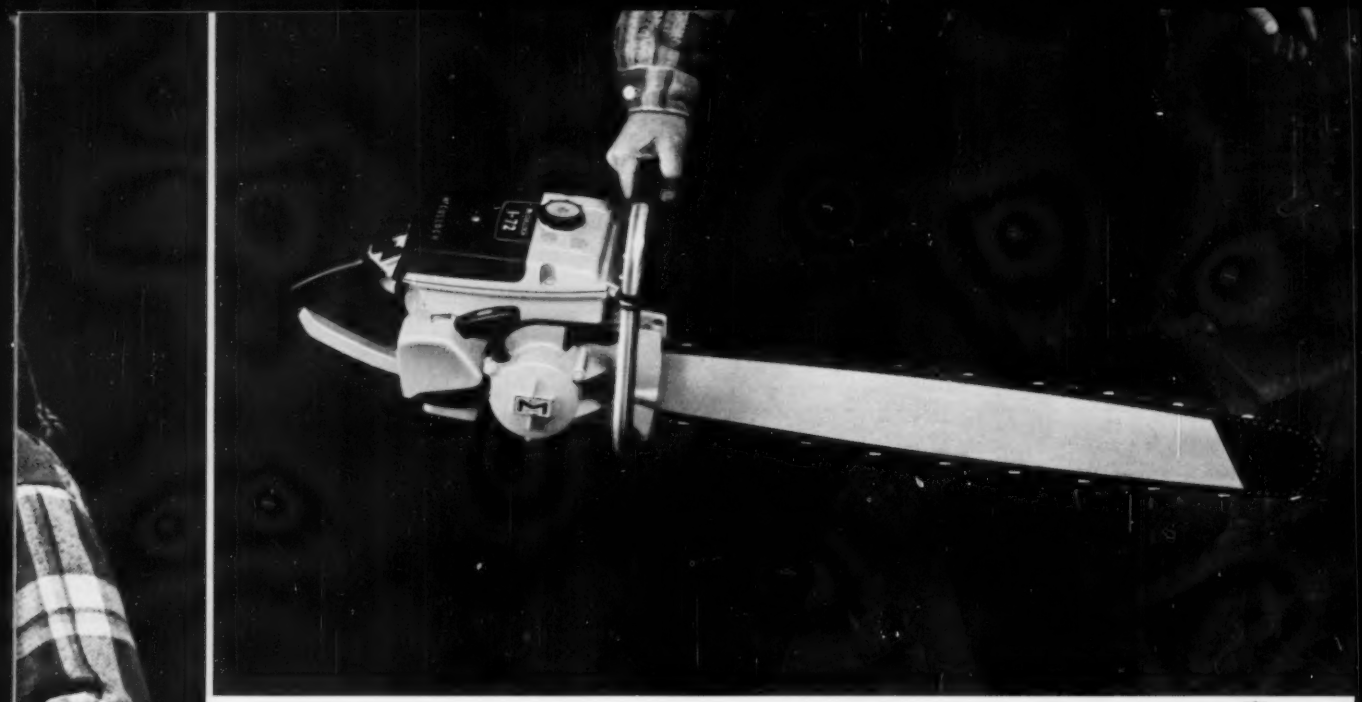

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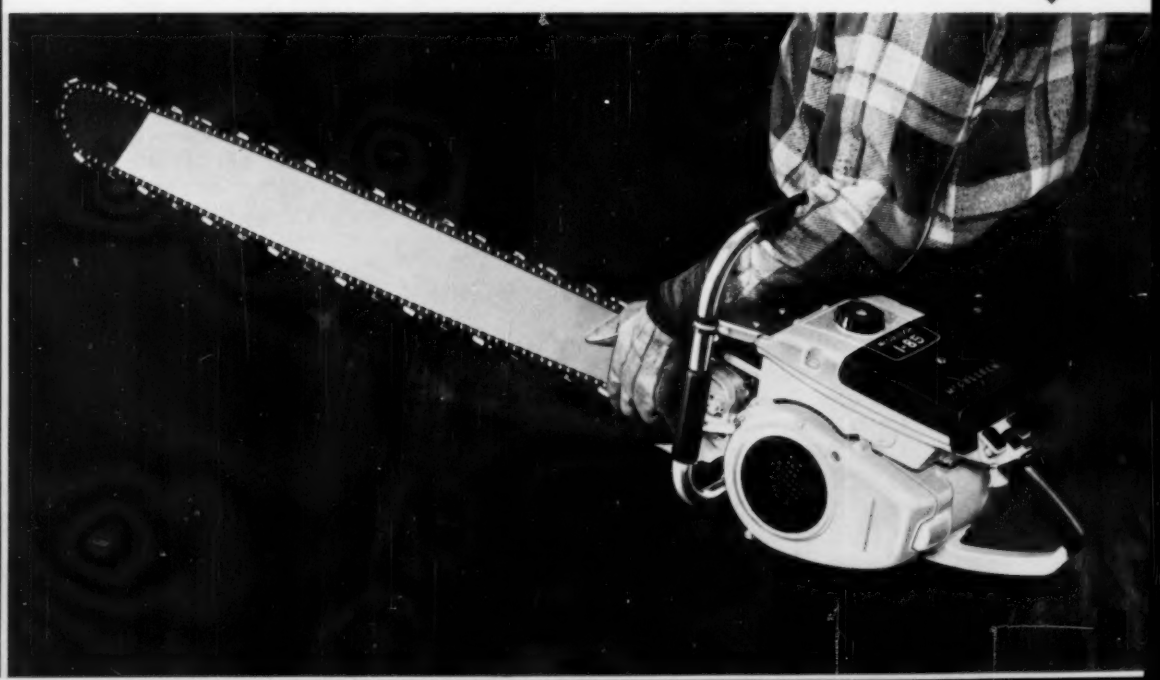
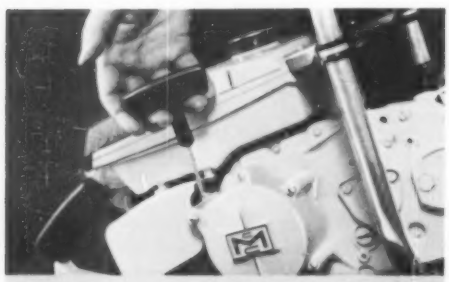
NEW **ONE/85** Completely shock-mounted, heavy-duty gear-drive with the extra lugging power you need for felling big timber. 3.6:1 gear ratio. Fingertip controls, insulated fuel tank, and operator convenience features make the ONE/85 easy to handle on the toughest terrain. Standard equipment includes Town and Country muffler and McCulloch's Super Pintail chain. Takes bars up to 42″, plus 15″ Plunge Bow, 24″ Paddle Bow, 24″ Speed-Tip Bar.



CONVENIENCE FEATURES	ONE/72	ONE/82	ONE/85	ONE/92
Lightweight construction	21 lbs.	24 lbs.	24 lbs.	34 lbs.
Handlebar design	Wrap around, mounted on rubber shock-absorbers			Motorcycle type with 4 rubber mounts
Fingertip controls	Rubber padded controls throughout			Yes
Muffler	Exclusive two-position Town and Country			Standard spark arrestor
ENGINEERING SPECIFICATIONS				
Type of drive	Direct	Gear	Gear	Gear
Gear ratio	1:1	3:1 or 3.6:1	3:1 or 3.6:1	4.22:1
Carburetor	Improved diaphragm type for all position cutting			
Intake valve	Tuned reed and 3rd port			
Rings	2 narrow chromed steel compression rings			
Piston	Permanent mold aluminum			
Cylinder design	Deep finned aluminum alloy with reborable cast iron liner			
Displacement	5.3 cu. in.	5.3 cu. in.	5.8 cu. in.	6.3 cu. in.
Compression ratio	6.25:1	6.25:1	6.25:1	6.1:1
Chain	McCulloch Super Pintail			Super P9

Weights less bar and chain. Prices and specifications subject to change without notice.

COMPARE McCULLOCH'S VALUE FEATURES: Cylinders are reborable without expensive block replacement. Flocked-screen air cleaners resist moisture, outlast ordinary paper filters many times over. Non-spill fuel tank venting prevents fuel leakage when operating or carrying saw—stops dirt and dust entry two ways. Felt-wick pick up, insulated fuel tank, precision bearings, streamlined body styling, high strength fasteners throughout—these are some of the reasons why McCulloch is the number one choice of professional loggers.



START QUICKER under all weather conditions. You get optimum combustion from McCulloch's new combustion chamber design. Vital ignition points are protected against dirt, oil and moisture by the new labyrinth seal on the flywheel and front cover plus breaker box seals and internal venting. Air-cooled coil is fully weatherproofed for long life. Starter rope is solid nylon with form-fitted rubber handle.

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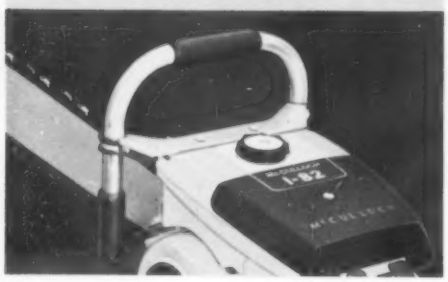

SHOCK ABSORBERS on ONE/72, ONE/82, and ONE/85 give you operating convenience no other saws have. Contoured rubber pistol grip, padded choke and oiler buttons, and a handlebar completely insulated against engine vibration. These exclusive features take the jolt out of all day cutting.

You can own a new McCulloch chain saw for as little as $7.21 per week on approved credit. Choose the model you need from McCulloch's *complete* line of professional saws. Dependable McCulloch service, McCulloch's fast cutting—long lasting Super Pintail chain, and factory authorized parts are readily available from your nearby McCulloch dealer, a good man to know. For more information write Dept. I, McCulloch Corporation, 6101 West Century Boulevard, Los Angeles 45, California.

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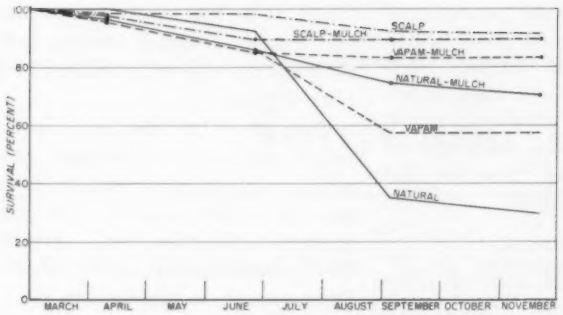

FIG. 3.—Cumulative average survival.

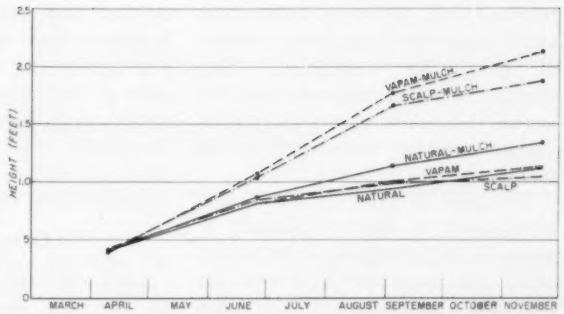

FIG. 4.—Cumulative average seedling heights.

Seedlings on the Vapam-mulch and scalp-mulch treatments continued their April-June rate of height growth through the July-September period. Growth on all other plots fell off during this period, though the natural-mulch plots maintained a somewhat higher rate than the unmulched treatments.

Seedlings on mulched plots had greater diameters than those on unmulched plots (Fig. 5). In general, treatments which produced the tallest plants also developed those of largest diameter. Exceptions were the "leggy" seedlings on the unmulched natural and Vapam plots, which, though about the same height as those on the scalped plots, were considerably more slender—probably as a result of competition for light.

Mulched seedlings were heavier than those not mulched, average oven-dry weights varying from 21.8 to 102.5 grams for mulched and 10.7 to 19.8 grams for unmulched (Fig. 5). Moisture content was higher in plants from mulched plots—the average ratio of green to dry weight was 2.47 on mulched plots and 2.29 on unmulched.

As early as April 1958, two months after planting, the seedlings on scalped (unmulched) plots had developed a yellowish hue that persisted until early September, and then changed to a darker green. By the end of November, only three to four plants per plot were still yellowish (2.5 gy 6/8 yellowish green-yellow by the Munsell color code); the rest were green (7.5 gy 6/5 greenish green-yellow). No yellowing was observed on seedlings in other treatments.

TABLE 3.—SEEDLING MORTALITY BY TREATMENT AND CAUSE[1]

Treatment	Mortality by apparent cause			
	Planting shock	Rodents	Drought	Total mortality
	Percent			
Not mulched				
Natural	0.0	0.9	69.5	70.4
Vapam	1.9	.9	39.9	42.7
Scalp	1.0	.9	6.5	8.4
Mulched				
Natural	2.8	3.7	23.2	29.7
Vapam	3.8	.0	13.0	16.8
Scalp	2.0	8.2	.0	10.2

[1]Basis: 108 seedlings per treatment.

Interrelations

Seedling survival was primarily associated with the amount of soil moisture under the various treatments, especially during the July-August drought.

Seedling growth seems to reflect rather complex relationships. Best development occurred on two of the best watered treatments, but on the third (scalped) the seedlings were short and their dry weight very low. While this poor development on the scalped plots may have been due in part to lower moisture levels earlier in the season, the chlorosis suggests nutrient deficiency due to removal of the topsoil. The superiority of seedlings on the Vapam-mulch plots over those on the scalp-mulch, despite better moisture on the latter, tends to support this hypothesis.

On the natural, natural-mulch, and Vapam-mulch treatments, where no topsoil had been removed, the stunting of seedlings probably

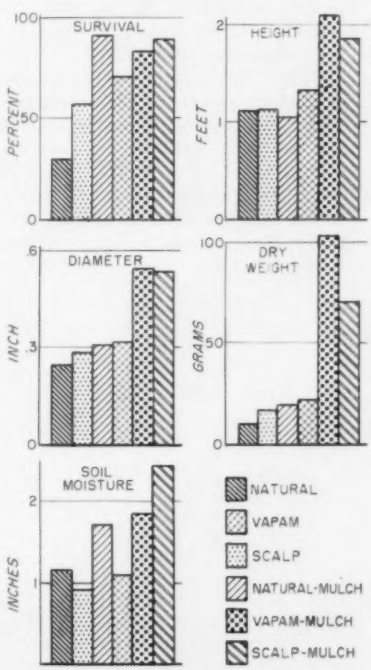

FIG. 5.—Growth features and soil-moisture content by treatment.

resulted from moisture deficiencies attributable to inadequate control of competing vegetation. The slightly better development on natural-mulch plots probably reflects higher moisture levels early in the season.

The role of pine mulch in this experiment is rather difficult to assess. Undoubtedly its most potent effect was to suppress vegetation that was competing with the pines for soil moisture. It appeared to improve infiltration of rain and to reduce losses from evaporation, though the magnitude of these effects was not measured. It was evident, also, that the nutrient deficiencies that caused poor growth and chlorosis on scalped plots were so well replaced when mulch was applied that the scalp-mulch treatment produced seedlings almost as large as those on the Vapam-mulch plots.

Conclusions

Low survival of planted pines during dry weather emphasized the need, in east Texas, of controlling vegetation that competes with seedlings for soil moisture.

In a critical drought those scalping, mulching, and chemical treatments that best controlled weeds and grasses retained highest soil-moisture content and produced best pine survival.

The effect of the pine-needle mulch was chiefly to smother competing vegetation. Mulch probably also increased moisture through greater infiltration, and contributed some nutrients that stimulated growth on plots where scalping had removed topsoil.

In view of the frequent droughts in east Texas, it appears unwise to plant pine seedlings without some form of site preparation.

Travel Grant Applications Invited to IUFRO Conference

The Society of American Foresters has received a grant of $10,000 from the National Science Foundation to assist qualified American scientists to travel to Vienna, Austria, to attend the 13th meeting of the International Union of Forest Research Organizations, September 9 to 22.

IUFRO has an international congress about every five years. Its program, organized in 11 sections, deals with research projects of common interest to many nations. Technical papers are invited on topics chosen for the agenda of each section, and others may be contributed. About fifty member nations are expected to send 200 to 250 research scientists to the meeting in Vienna this year.

American scientists who plan to go to Vienna, who have interests in forestry research, and who need financial assistance for travel may apply to the Society of American Foresters, 425 Mills Building, 17th Street and Pennsylvania Avenue N.W., Washington 6, D. C.

Each applicant is requested to supply the following information:

1. A short professional biographical sketch, including present affiliation and research activities.

2. Purpose of attending IUFRO meeting and specific participation in the program, if any.

3. Estimate of amount of travel assistance needed.

Travel grants will be limited to round-trip airplane fare from the grantee's home to Vienna, Austria, and return, or some fraction thereof. Applications must be received by June 10, 1961 to be considered. They will be reviewed by a special committee under the chairmanship of Dr. V. L. Harper, chairman of the Society's Committee on International Relations.

Notes and Observations

A Reliable Oak Seed Trap

Accurate estimates of acorn crops require the capture of all acorns falling into the seed traps —none should bounce out. Few of the traps developed so far meet this requirement, particularly in the southern bottom land forests where oaks often reach heights of 100 feet or more. An example of existing traps is the paperboard seed trap designed by Easley and Chaiken[1] for pine seed. As originally designed, the trap is a four-sided, inverted pyramid with a sampling area of ¼ milacre. It caught only 7 percent of the acorns dropped from a 90-foot fire tower. Covering the traps with poultry netting, draping them with burlap, or using vertical cloth baffles reduce but do not eliminate the losses. Anyone with a supply of these traps on hand, however, can easily convert them into reliable seed traps for oak.

Conversion, by removing one of the side panels and reassembling as a three-sided trap, gives greater efficiency (Fig. 1). Over 90 percent of the acorns dropped from 90 feet were caught. An even better trap is obtained by cutting a narrow, triangular strip, 3 inches wide at the top, from both ends of each panel (Fig. 2), and reassembling the trap into a steeper, three-sided version. All acorns dropped into this trap from the fire tower were captured. The sampling area of this version is 3.40 square feet, or 0.08 milacre.

Success in trapping depends a great deal on the way the acorns bounce. In the original four-sided trap the first and second bounces are upward—acorns escape easily. In the three-sided traps deflection is downward, increasing as the sides of the trap are made steeper. Naturally, this change affects the angle of the third bounce which is theoretically slightly upward in the first modification and nearly horizontal in the second (Fig. 3). But acorns lose speed with each collision and actual trajectories and impact points are lower than in the theoretical paths. The first modification catches a high percentage of acorns because the acorn is deep within the trap by the third bounce and usually lacks sufficient momentum to bounce out. The second modification works much better because the third bounce is deeper and seemingly d o w n w a r d. Of course, acorns are not spheres and may develop some spin as they fall. Furthermore, the paperboard is not a perfect deflecting surface. Aberrant bounces may occasionally occur with the possibility of acorn losses. But the empirical tests show that losses, if any, will be small.

A larger trap with an area of 1/10 milacre can be made to increase the sampling size and facilitate computations. The dimensions of one of the three identical sides of a 1/10 milacre trap are given in Figure 4. The angles of this trap nearly duplicate those of the successful second modification, and the larger size should give an even greater acorn-capturing efficiency.

For field use, the modified trap is assembled and set up as described by Easley and Chaiken. Discarded luncheon meat cans, with holes punched downward through the can bottom to provide drainage, may be used as seed containers. A fine mesh screen placed over the inside bottom prevents loss of small seed and reduces plugging of the drain holes. A triangular hardware cloth funnel extending into the can acts as a predator guard.

[1]Easley, L. T., and L. E. Chaiken. An expendable seed trap, Jour. Forestry 49:652-653. 1951.

FIG. 1.—Collecting seed from a three-sided trap.

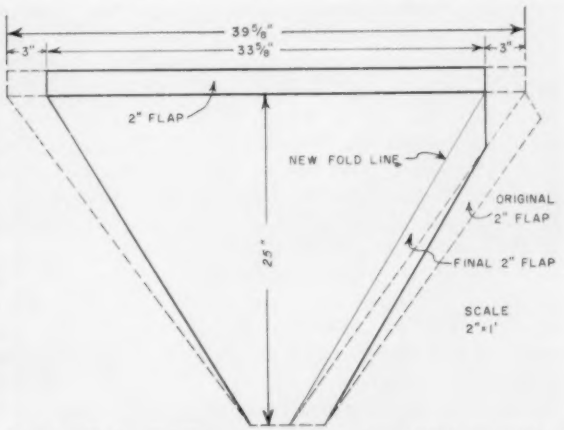

FIG. 2.—Easley-Chaiken pine seed trap is modified by cutting away portions from the ends of each panel and reassembling as a three-sided seed trap.

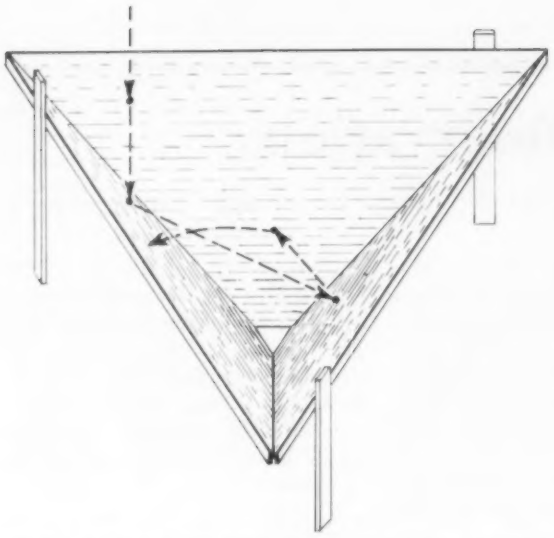

FIG. 3.—The theoretical series of bounces made by an acorn falling into a three-sided trap. In practice, the acorn loses much of its momentum by the fourth bounce.

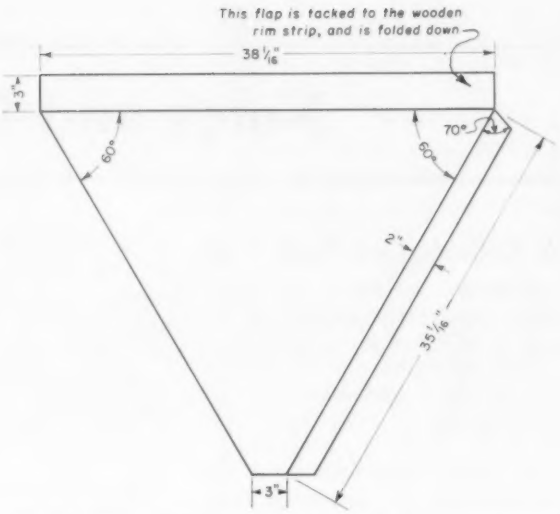

FIG. 4.—Pattern for a section of a 1/10 milacre three-sided seed trap.

The small end is just big enough to pass the largest acorns. The large end is wired over the triangular opening at the base of the paperboard trap. No predator guard or other obstruction should be placed above the trap's top or bottom openings or acorns will be deflected out. The paperboard portion of the new 1/10 milacre acorn trap is available from the International Paper Company, Container Division, Georgetown, S. C.

RALPH A. KLAWITTER
and JACK STUBBS
Southeastern Forest Expt. Sta., Forest Service, U. S. Dept. Agric., Asheville, N. C.

Photographic Observations of White Pine Seed Destruction by Birds and Mammals[1]

The recent development of special photographic equipment has introduced a new technique for studying forest-animal relationships. A camera synchronized to an electronic flash unit permits photographing animal activity and makes it possible to record such supplemental data as temperature, relative humidity, and time of day when activity occurs. Pearson (*3*, *4*) has successfully used photographic recorders to study the habits of small mammals (*Microtus* and *Reithrodontomys*), and the coauthor has used similar equipment in studies concerning the ecology of the porcupine.

This equipment, when operated in areas where tree seed is disseminated naturally or by direct seeding, can record information on seed depredations by birds and mammals. Some preliminary results obtained by using a photorecorder for this purpose are presented here.

The equipment used in this study was developed by Dodge and Snyder (*1*). It consisted of a 16 mm. movie camera synchronized for single frame flash operation; a photoelectric mechanism, powered by a 6-volt storage battery, for tripping the shutter; and a battery-operated flash gun. A unit composed of a dial thermometer and a clock was included to record temperature and time of day when each photograph was taken.

The recorder was stationed in a ½-acre stand of eastern white pine (*Pinus strobus* L.) on the University of Massachusetts Mt. Toby Forest in September 1959. This stand had received a shelterwood cutting the previous spring and the ground was well scarified to encourage germination. Several large trees supported an abundance of cones. A small mammal census showed that there were eight white-footed mice (*Peromyscus leucopus*) inhabiting the stand. Two red squirrels (*Tamiasciurus hudsonicus*) were seen collecting green cones; a gray squirrel (*Sciurus carolinensis*) occasionally visited the area, and a pair of white-throated sparrows (*Zonotrichia albicollis*) were also present.

Seed dispersal began on September 6. Two weeks later, when many seeds were visible upon the ground, the photographic equipment was placed in operation. Several pine seeds were collected from the ground and placed advantageously so that animals feeding upon them would break the light beam and trip the shutter. This bait was later replenished as needed with commercial pine seed.

After 14 days of operation, the recording equipment was removed and the film developed. A total of 425 frames was exposed. Gray

[1]Contribution No. 1267 of the Massachusetts Agric. Expt. Sta., Amherst.

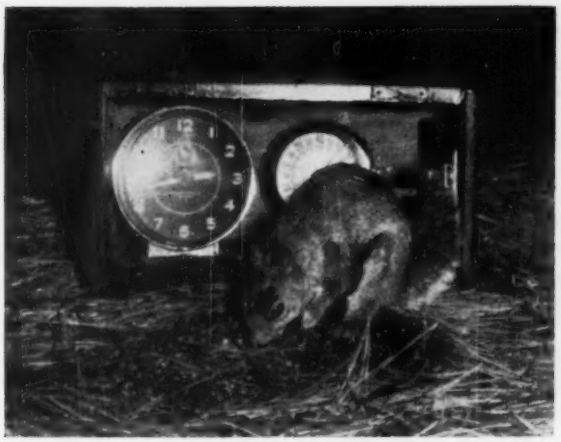

FIG. 1.—Gray squirrel eating white pine seed (2:43 p.m.).

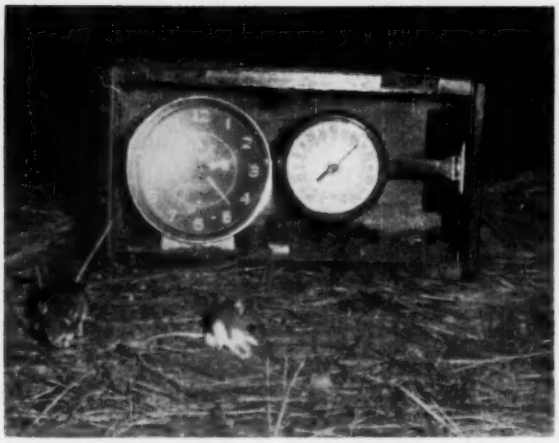

FIG. 2.—Two white-footed mice feeding upon white pine seed (2:23 a.m.).

squirrels were responsible for 338 of the exposures; white-footed mice, 49; and white-throated sparrows, 38. No red squirrels were photographed. Figures 1 through 4 are representative of the photographs taken and substantiate the fact that these animals destroy white pine seed.

Gray squirrel activities, which dominated the daylight scenes, are of particular interest, for this animal is not generally considered a consumer of white pine seed. It fed upon the seed 7 of the 14 days the equipment was in operation, the majority of this feeding taking place during the late morning and afternoon hours. More than one-half of the pictures of this animal were taken in one day between the hours of 1:50 p.m. and 4:55 p.m.

White-footed mice, well-known for their seed-eating habit, were photographed throughout the hours of darkness but were most active in their feeding between 11:00 p.m. and 3:00 a.m. These observations compare favorably with those of Orr (*2*) who found that activity began at dusk, reached a peak around midnight, but declined gradually until dawn with a slight recovery about 3:00 a.m. Several pictures, each showing two animals (Fig. 2), may indicate that *Peromyscus* tend to travel and feed in pairs. Figure 3 is included as evidence that white-footed mice not only consume white pine seed *in situ* but carry away and store seeds as well.

Photographs of the white-throated sparrow merely serve to add this bird to the list of many avian species known to feed upon pine seed. Although it has been noted by the authors that soil scarification usually attracts birds, the small size of this study area and its location are believed responsible for the scarcity of bird life.

The failure to photograph red squirrels and the visual evidence that these animals persistently collected green cones, while apparently ignoring the disseminated seed available to them on the ground, suggest the nature of their depredatory influence on white pine seed crops. Seed losses caused by this species might be greatly reduced by protecting cones for a relatively brief period prior to the time of seed dispersal.

Further photographic studies conducted on larger areas, with more prolific seed crops and supporting animal populations of greater numbers and variety of species, are recommended. Such studies should not only document the influence of birds and mammals on tree seed crops but should

FIG. 3.—White-footed mouse, with cheek pouches filled with pine seeds (12:43 a.m.).

FIG. 4.—White-throated sparrow, a consumer of white pine seed (9:15 a.m.).

also contribute to our knowledge of forest-animal relationships and to the ecology of the individual species involved.

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HERSCHEL G. ABBOTT
University of Massachusetts, Amherst
and WENDELL E. DODGE
U. S. Fish and Wildlife Service, Denver, Colo.

Fertilizer and Mulch Aid Grafting of Slash Pine

Survival of slash pine (*Pinus elliottii* Engelm.) grafts may be improved by fertilizing and mulching the rootstocks. In a study in south Mississippi, the number of successful unions was more than doubled by fertilizer and tripled by a combination of fertilizer and pine needle mulch.

Twenty-month-old potted slash pine stock was transplanted to the field in January 1956. At this time four treatments were applied to the stock plants: 0.5 pound of 5-10-5 fertilizer broadcast around the tree within a 15-18 inch radius; 1.5 pounds applied in the same manner; 1.5 pounds plus a pine needle mulch 1 inch thick; and control—no fertilizer or mulch. In April scions from three trees, 25-40 years old, were established upon these stock seedlings by the succulent-tissue cleft-graft technique. A total of 108 grafts were made (4 treatment plots, each composed of 3 grafts of each of 3 ortets, times 3 blocks).

The spring of 1956 was dry, there being only 3.68 inches of rain between mid-March and mid-June. The percentages of scions living on June 14, 1956, are given in Table 1; only two scions died after this date. There was no mortality in the rootstocks.

The scions from tree B had about twice the survival of those from the other two trees. Statistically, the survival of scions of any ortet differed very significantly from the survival of scions from the other ortets.

TABLE 1.—PERCENT OF LIVING SCIONS BY PARENT TREE AND TREATMENT

Fertilizer per tree (Pounds)	Ortet A	Ortet B	Ortet C	Average
0	11	44	11	22
.5	56	89	22	56
1.5	44	89	22	52
1.5 with mulch	56	89	67	71
Average	42	78	30	

Fertilizing the rootstock increased survival 30 percent; mulching caused an additional increase of 20 percent. The untreated controls, and the fertilizer-plus-mulch treatment, were very significantly different from each other and from the 2 levels of fertilization without mulch. The increase in average survival for the fertilizer-plus-mulch treatment over the two fertilizer treatments was due to the increase in the number of successful grafts of tree C. There was little response when the mulch was used with the scions of trees A and B.

One-half pound of 5-10-5 per seedling supplied all of the N, P, and K needed during the period of test, for no additional response was secured from triple this amount. Johansen and Kraus[1] obtained no increase in scion survival when they added a nutrient solution in the bottles of bottle grafts or applied a nutrient spray to cleft grafts. Evidently, the effect of the fertilizer in the present study was to improve the vigor of the rootstocks and thus to hasten healing at the graft. The timing of fertilizer placement probably is important, but that was not tested here.

R. M. ALLEN AND N. M. SCARBROUGH
Southern Forest Expt. Sta., Forest Service, U. S. Dept. Agric. New Orleans, La.

[1]Johansen, R. W., and J. F. Kraus. Fertilizing cleft and bottle graft scions in an attempt to increase graft unions. Jour. Forestry 57:511-514. 1959.

de Liocourt's Method, Modified

In recent years there has been a number of interesting and thought provoking articles in the JOURNAL OF FORESTRY dealing with de Liocourt's method of presenting diameter distributions in all aged stands. The late H. Arthur Meyer has developed a detailed analysis of an exponential formula and presented this in his text *Forest Mensuration* and with Recknagel and Stevenson, in the text *Forest Management*.

Two of the essential features of the method are first that the relationship of the number of trees per acre when plotted over d.b.h. produces a straight line on semi-log paper, and second, de Liocourt's q which is the ratio of the number of trees in any given diameter class to the numer in the next larger diameter class. This value of q is constant for the whole distribution of diameter classes (of a constant interval—such as one inch classes, two inch classes, etc.). The formulae that have been published by Meyer[1] and that have been used are special cases of a more general formula which is presented below.

The method in general is of value as it presents a means of studying the stand structure of all-aged forests and a means of determining the cut for forests of this type. It has not been used extensively as a management tool up to this time primarily because it has not been too thoroughly understood. It has been advocated for use in all aged stands and it is more applicable

[1]Meyer, H. A. Forest mensuration. Penns Valley Publishers, State College, Pa. pp. 321-333. 1953.

to such stands. It is, however, found applicable to certain even-aged stands of mixed species. This promises some additional uses and, it is hoped, additional useful information regarding the relationship of stand structure with tree species.

Actually, the test is applied to a stand table by plotting the number of trees in each d.b.h. class over d.b.h. (or number of trees per acre over d.b.h.) on semilog paper. The points plotted should delineate a straight line if the data from which the points are plotted represent a balanced stand structure.

It is usually desirable to calculate de Liocourt's q and it may be found desirable to make additional calculations despite the fact that most of the essential information may be taken from the plotted lines. The general formula for an exponential curve is $y = kb^x$. In this case since we are dealing with decreasing numbers of trees, y, in each larger diameter class, x, the formula best adapted to this work is $y = kb^{-x}$, a general form that indicates a negative slope. If N_1 is the number of trees in a given d.b.h. class and N_2 is the number in the next larger diameter class then de Liocourt's q is equal to N_1/N_2. This ratio regulates the slope of the line and can be substituted for b in the general formula so that in specific form we have $N = kq^{-D}$. If it is desired to obtain the value of the constant k it is only necessary to extend the straight line of the semilog graph to intersect the N ordinate at $D =$ zero at which reading $N = k$ (the y intercept).

It has been indicated in some of the articles on this method that k is an index of stocking. This is true only if the individual line drawn on the graph is considered in relation to some other line having the same q (slope). This does not occur very often as the line for a proposed future diameter distribution practically always has a different slope (q value).

In making comparative studies among stands it is usually desirable and informative to obtain the value of q for each stand as one of the bases of comparison. There are a number of ways of obtaining this value but probably one of the simplest methods which supplies one of the most reliable values is obtained very rapidly by solving for q in the formula. As was shown above the value of k is the value read from the chart as the y or N intercept. To obtain q, select any convenient point on the straight line and read the coordinates of this point. These are values of N and D. Substitute these in the formula and obtain the value of q. As an example, one of the stands of hemlock-hardwood Site II sawtimber with which we have been working in Lewis County, New York, develops a k or N value (y intercept) of 120 trees when the D (b.h.) is zero. A point was selected on the linear regression line plotted on semilog paper which gave the coordinates $N = 20$ and D(b.h.) $= 10$. Substituting these values in the formula $N = kq^{-D}$ $20 = 120\ q^{-10}$ and $q = 6^{0.1} = 1.196$.

As we are obtaining these values for q for many stands it can be readily appreciated that taking the tenth or any other root of the number would become an onerous task. This is accomplished with speed and consummate accuracy on a log-log slide rule (and in the above case of the tenth root with only one setting of cursor).

It should be noted that in using the formula as presented here, one inch diameter classes are used. Should two inch classes be used, the formula would become $N = kq^{-D/2}$. In the above example, this would change the value of q to $q = 6^{0.2} = 1.430$, which could likewise be obtained by squaring the value for q of 1.196 for the one inch classes. Or in the general case, $N = kq^{-D/i}$ when "i" is the interval used for diameter classes.

In summary, the foregoing is presented as a modified, generalized and simple formula applicable to de Liocourt's theory of stand structure and a simple and direct solution for the evaluation of each of the components of the formula. It is hoped this may facilitate the work of those using this method.

JOHN C. SAMMI
State University College of Forestry, Syracuse, N. Y.

Points of View

Additional Answers to Questions Concerning Registration and Licensing of Foresters

It is not the purpose of the SAF Committee on Registration and Licensing of Foresters to enter into argumentative debate with individual members of the Society concerning the merits of registration and licensing of foresters. Each member has a right to his viewpoint. It is the province of the Committee, however, to present the facts to the membership at large, and to correct any misapprehensions that may exist. Specific reference, at this time, is made to the article in the Points of View section of the January 1961 issue of the JOURNAL OF FORESTRY, titled "Registration of Foresters —The Negative." Several questions asked and comments made in this article can and should be answered.

One misapprehension which seems to plague foresters in their initial contact with the possibilities of registration and licensing is that the purpose is to benefit or protect the forester by giving him greater professional standing, and possibly more material benefits. True enough, such may accrue to foresters eventually, but not because of registration and licensing, except in a secondary manner. The purpose of all of the registration and licensing acts now in effect and those proposed, *is for the benefit and protection of the public.* Laws of this type for any other purpose would no doubt be declared unconstitutional. Most likely, because of the altruistic approach of these laws, the standing of foresters and the profession of forestry will be enhanced; but this is not the avowed intent and purpose of registration and licensing.

Recognition and acceptance of the fact that registration and licensing is for the benefit and protection of the public will do much to alleviate misconceptions concerning such laws. For instance, the "red herring" that licensing is only for consulting foresters, which is constantly being expounded by those opposed to licensing, is a good example. Registration and licensing is for all foresters, not just for consulting foresters. Associated with this misapprehension that licensing is just for consultants is a fairly common feeling that foresters working for the federal government and private concerns should never have to be licensed. Since it is the public, however, who will benefit from registration and licensing it is the public who will benefit to the greatest degree by the registration and licensing of foresters who manage public lands. Likewise, if industry has a public responsibility to properly manage their forest lands then the public will benefit to the greatest degree by the registration and licensing of industrial foresters. True, none of the present laws requires the registration and licensing of foresters operating on their own lands or on the lands of the company or agency that employs them full time, but this does not invalidate the reasoning. In fact, in the Southeast, the U. S. Forest Service encourages their employees to become licensed, and some of the industries demand it. In areas where forestry is an accepted practice by the public, and where proper and ethical practice is recognized by the public as a vital economic necessity, public demand of proof of qualification, not mere place of employment, is not absent.

The question of how many foresters are concerned with registration is a moot question. If the proper management of all forest land, regardless of ownership, is of importance to the public then practically all foresters are in one way or another concerned with registration and licensing. Many will not be required to be licensed for some time to come; but again, this does not invalidate the fact. It may never be, and probably would not be necessary for all states to license foresters. Some states in which forestry is not a great economic factor may wish to accept the license of another state as adequate; however, this has seldom proven to be the rule with other licensing laws or in other fields of endeavor. A certain state pride apparently overrides economic reason in such cases.

The question also seems to arise again and again as to what is a forester. This requires two answers or explanations. First, registration and licensing laws do not attempt to reserve the use of the name forester to any specific group. This is as impossible as trying to reserve the name "doctor" to Doctors of Medicine, or the name "engineer" to Civil Engineers. The registration and licensing laws do reserve the title "Registered Forester" to those properly registered and licensed. Secondly, the definition of what a forester *is* does not enter into registration and licensing. What a forester *does* is important. To quote the Georgia Law for the registration and licensing of foresters (the Michigan and Alabama laws are comparable):

> Registered forester shall mean a person who has registered and qualified under this law to engage in professional forestry practices here-

> inafter defined.
> Professional forestry or practice of professional forestry shall mean any professional service relating to forestry, such as investigation, evaluation, development of forest management plans or responsible supervision of forest management, forest protection, silviculture, forest utilization, forest economics, or other forest activities . . .

Since the passage of the Georgia law, little doubt remains in the public mind as to what a Registered Forester does. Nonprofessional services are eliminated by definition. The law is not deficient.

In so far as the individual forester is concerned registration and licensing presents no problem for the adequately trained forester with a B.S.F. degree. Where licensing is in operation, and licensing is necessary for the type of work to be done, the employer's standards include licensing and frequently membership in the Society of American Foresters as well. One fact is certain, forestry registration and licensing has strengthened the Society of American Foresters both in standing and in membership in the three states where licensing exists. It should also be pointed out that licensing is not expensive. The annual fee in Georgia is five dollars.

There is no problem in licensing when a forester is transferred to, or accepts a job in another state. He merely drops his license in one state and becomes licensed in the other. This involves the necessity of writing a letter to the state board in the state of his new residence informing them of his transfer and furnishing proof of his previous registration and licensing. Reciprocity problems will only arise where one state does not require standards comparable to those of other states. Such a situation has not arisen between the three states now licensing foresters and is not anticipated. As licensing spreads to other states such problems may occur. They have occurred in the other professions. Not all men think alike, but intelligent men can resolve their differences without destroying their citadels, or failing to enact laws which are for the common good.

As has been mentioned in other articles in the JOURNAL OF FORESTRY, licensing on a national rather than on a state level is not considered to be either feasible or in the best interests of all concerned. Being a member of the Society of American Foresters, or adhering to a set of standards set forth by the Society is not enough. Loss of membership in the Society, the ultimate penalty, would carry no weight except dishonor among other members, and persons subject to such a penalty would most likely have little honor to lose. Also, threat of loss of Society membership would have no effect upon foresters, or others, who are not members of the Society of American Foresters. And of even greater concern is the fact that historically and constitutionally licensing is a state matter, involved in states rights, and not one to be considered as a national endeavor or obligation. Also, forestry varies so greatly from region to region, and emphasis on different phases of forestry varies to such a degree, that national standards are implausible and would be unwise.

Three pertinent questions were asked in the article previously mentioned. They require direct answers.

1. "When a restrictive type of legislation is proposed it is usually wise to investigate the motives and the possible gains; who is it who seeks to obtain restrictive legislation in forestry practice?"

First, if a law written for the benefit and protection of the public which only requires that those persons who serve the public be adequately trained and excludes those persons who are not adequately trained, can be called restrictive, then it is agreed that restrictive is a good name for registration and licensing laws. As to who it was that sought to obtain such legislation in Georgia, Michigan and Alabama, it was the duly authorized Chapters and Sections of the Society of American Foresters in those states. Investigation of the possibilities of licensing and other action leading to legislation is being undertaken by other Chapters and Sections of the Society of American Foresters in the States of California, Florida, Minnesota, Mississippi, South Carolina, Tennessee, Kentucky, Washington, Wisconsin, and possibly others.

2. "What do they define as the area of interest?" Since all of the existing and proposed laws so state, no doubt the area of interest is the benefit and protection of the public.

3. "Can we be sure that part of the motivation for registration is not to seek ultimately to restrict the number of people who may practice forestry in order to create an artificial shortage of practitioners?"

The laws are definitely for the purpose of ultimately reserving the practice of forestry to those who are adequately trained in the science and art of forestry. As for the inference that the laws are for the purpose of creating an artificial shortage of practitioners, the question hardly deserves the dignity of an answer. Suffice it to say that such is not the case.

As stated in the article: "A continued strengthening of the membership requirements of the Society and an upgrading of admission requirements are part of the process of gaining professional stature. Improvement in education is in no way provided for in existing registry laws." Both are true statements. Strengthening of membership requirements, upgrading of admission requirements, and improvement in (forestry) education are the historic prerogatives of the Society of American Foresters. Registration and licensing does not pretend to preempt these prior and exclusive rights.

The Society of American Foresters is firmly behind the registration and licensing of foresters. The Committee on Registration and Licensing of Foresters was authorized and appointed by unanimous vote of the Council of the Society at the national meeting held in San Francisco, 1959, and was asked to advise Section and Chapter Committees on procedural matters with respect to licensing, and to assist these committees to the best of their ability when requested. At the national meeting in Washington, D. C.,

1960, this Committee on Registration and Licensing was made a permanent committee by the Council, and in addition the Council unanimously approved a resolution which among other things approved and encouraged the registration and licensing of foresters who qualify under *state laws*. The Council also recognized by means of this resolution that registration and licensing is a means of informing the public of the professional status of foresters, and pledged its support and assistance to Sections and Chapters engaged in the development and strengthening of state laws on registration and licensing of foresters.

A complete and careful reading of the resolution by all members of the Society would be of value to them and to the Society as a whole. The resolution can be found in the JOURNAL OF FORESTRY, January 1961; vol. 59; no. 1; p. 33.

ARCHIE E. PATTERSON
Chairman, Committee on Registration and Licensing, SAF

Further Comment on "Economic Models for Thinning and Reproducing Even-Aged Stands"[1]

We welcome the JOURNAL's publication of Vollrat von Deichmann's long comment[2] on our January 1960 paper and agree with him that comment is due for the same reason he specifies—lest silence be construed as assent without critical examination.

A careful reading of our previous paper "Financial Maturity—What's It Good For?"[3] will dispel much of the concern expressed by our colleague. It discusses several of the points which von Deichmann misses in our more recent paper, "Economic Models . . ." These papers should be studied together, for each was written with the other in mind.

Our models do not necessarily "result in a drastic reduction of rotation age and even in an accepted loss of heavy-timber production." The models leave the forest owner free to choose his own guiding rate of return. A low rate will lead to long rotations and heavier growing-stock investments; a high rate to short rotations and lower growing-stock investments. He may even choose a rotation age which maximizes the mean annual value increment which is analogous to the use of a guiding rate of zero. The use of 5 percent in our case example, Table 2, is for illustration only.

The term "to maximize earnings" refers to maximizing dollar return to the forest business from capital invested at or above the guiding rate of return which reflects the owner's interest in capital saving and investment. From the investment viewpoint the guiding rate of the owner is the highest earning rate available to him for his last units of capital. Maximizing earnings does not mean maximizing *the rate* of return to the forest business. The latter, however, is the implicit goal for any owner whose financial status does not permit him to save and accumulate forest capital. It is this class of owner which has the shortest rotations and lowest growing stock.

The rationale behind our approach to model building is given in the following line of thought. The properly developed forest can be broken down into three major capital assets: (1) land, (2) growing stock, and (3) roads. Of these three, the largest capital item in terms of value per acre is the growing stock. In a well-balanced, managed forest, the growing-stock capital will be on the order of 10 to 20 times the value of the annual sustained wood yields. This tremendous ratio of capital to annual yields makes timber growing one of the most heavily capitalized enterprises in American business. Most business enterprises have a ratio of capital to sales income not in excess of 1 to 1 and often as low as ½ to 1. Viewed in this light, the business of timber growing is primarily a problem of capital management. The major cost of growing timber is the interest on capital. The primary responsibility of the forest manager in managing the forest business is to assure the owner that his forest capital remains invested at a rate of return consistent with his investment objectives, i.e., consistent with his guiding rate in planning investments. The potential significance of this responsibility is dramatically illustrated by analyses made by Ernest M. Gould in Harvard Forest Bulletin No. 29.[4]

The growth per acre produced by a timber stand provides a measure of the efficiency with which the soil, or land capital, is being utilized when it is compared to the full growth potential of that soil. The economic standard for evaluating the efficiency with which a stand is utilizing the land capital is given by the model in Figure 4 of our recent paper.

But the growth per acre tells little, if anything, about the efficiency with which the growing-stock capital is managed. Since the growing-stock capital ordinarily is several times greater than the land capital, its efficiency is relatively more important than the

[1] Fedkiw, John, and James G. Yoho, Economic models for thinning and reproducing even-aged stands. Jour. Forestry 58: 26-34. 1960.

[2] von Deichmann, Vollrat. Comments on "Economic Models for thinning and reproducing even-aged stands." Jour. Forestry 58: 970-972. 1960.

[3] Fedkiw, John, and James G. Yoho. Financial maturity—what's it good for? Jour. Forestry 54: 587-590. 1956.

[4] Gould, Ernest M., Jr. Fifty years of management at the Harvard Forest. Bulletin No. 29, Harvard University, Harvard Forest. 1960.

efficiency of land utilization. The measure of growing-stock efficiency is given by the value growth percent of individual trees, stands, or the forest as a whole.

Proper management requires the application of both standards in the manipulation of the stand. And such application should take account of the implications of the forest products markets and the effects of current management decisions on longer run interests of the owner in his forest enterprise. These latter considerations implicitly involve those biological aspects of the forest and soil which all foresters recognize have some practical importance but as yet are unable to quantify sufficiently well to deal with them in exact economic terms.

We have no doubt that the various silvicultural thinning grades can be economically right for particular circumstances. Our question is—when and for what circumstances and under what economic rationale?

Our models and conceptions are not the last word in this matter but we believe they are a step in the right direction. The objective, of course, is a consistent, quantified economic and biological rationale for the important even-aged case—a rationale which will make forestry practice more meaningful and understandable in our societal and business environment. Effective achievement of this goal requires that economists as well as silviculturists and other specialists come to grips with the problem in quantitative, mathematical terms.

We are unable to comment on the relevance of the references cited by von Deichmann. To our knowledge they are unavailable in English and our understanding of German is inadequate.

We take issue with the importance von Deichmann attaches to the order of the two main questions he sets forth in his last paragraph. The order he cites is simply the inescapable relationship between the purely natural order and the social order. Until biological alternatives, i.e., the relevant physical inputs and outputs, are properly identified and quantified, it is impossible to determine objectively which alternative is socially best. We would not reverse the order, but simply ask the question —which leg is more important if man chooses to walk?

John Fedkiw
Pacific Northwest Forest and Range Expt. Sta., Forest Service, U. S. Dept. Agric., Portland, Ore.
and James G. Yoho
School of Forestry, Duke University, Durham, N. C.

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Tree Planting Continued at High Level in 1960

Tree planting in the United States surpassed 2 million acres during 1960 for the second successive year, the U. S. Department of Agriculture has announced.

A summary of reports from the U. S. Forest Service field offices, state foresters, and other federal departments shows 2,137,460 acres were planted. Acreage planted to trees in 1959 was 2,151,743.

About 600,000 acres, or between 25 and 30 percent of the land planted, was cropland placed in the Conservation Reserve program under 10-year contracts.

A decrease in Conservation Reserve plantings occurred in one class of planting. Acreage planted to forest trees by small woodland owners in 1960 was 12 percent less than in 1959, when small private ownership forest planting came to 1,389,968.

"The effort of conservationists, forestry organizations, and forest industry with the help of local, state, and federal governments needs to be directed toward stimulating more planting on small woodland holdings," said Richard E. McArdle, chief of the Forest Service.

"A tenfold increase in planting on these small holdings is needed to eliminate the backlog in the acreage needing planting in this ownership group by the year 1970. Our present rate of planting has been little more than the replacing of trees depleted by cutting, fire, insects, and disease."

Tree planting stock was plentiful in 1960 in most states and is now adequate to plant many more acres than were planted in fiscal years 1959 and 1960, Chief McArdle stated.

Book Reviews

Trees, Shrubs and Woody Vines of the Southwest

By Robert A. Vines. xii+1104 pp. Illus. The University of Texas Press, Austin. 1960. $25.

In spite of certain limitations, this reference for plant scientists and amateurs merits a place among the illustrated floras of our country. The author is a science supervisor in Houston, Texas, and formerly was director of the Houston Museum of Natural History. His earlier book, *Native East Texas Trees* (131 pp., illus. 1953), has been incorporated into this much larger volume with two-column pages.

"Southwest" is defined on the jacket but unfortunately not on the title page by this subtitle: "A guide for the states of Arkansas, Louisiana, New Mexico, Oklahoma, and Texas," With a few additions, this reference primarily on the woody plants of Texas covers also the four bordering states, a doubled area one-sixth the size of the United States excluding Alaska. This area has state tree guides but no recent descriptive floras.

The 1,231 species of native and naturalized woody plants are described in detail, illustrated, and grouped into 102 plant families. The thorough coverage of trees, shrubs, and woody vines extends to dwarf shrubs, plants woody only at the base, and species newly published. Addition of some cultivated species as escapes though perhaps not widely naturalized adds to the reference value.

Scientific names mostly follow recent monographic treatments and botanical manuals, and no new names are proposed. The derivations are helpful, though a few are erroneous or omitted. A common name has been adopted for each species, usually from "Standardized Plant Names," but other names are mentioned.

The text for each species includes field identification (more properly size and form), flowers, fruit, leaves, twigs, bark (of trees), wood (of trees), range, and remarks. Some species have additional notes, for example, on varieties, horticultural forms, hybrids, and medicinal and other uses. Notes on propagation have been abstracted chiefly from "Woody-Plant Seed Manual." The bibliography and glossary are useful.

The largest genus, *Crataegus*, has 69 species of hawthorns and a key to species contributed by Ernest J. Palmer. *Rubus*, with 60 weak species of blackberries and raspberries, has been adapted from L. H. Bailey's publications. *Quercus* has 52 species of oaks and 12 illustrated varieties.

Absence of keys to families, genera, and species is the book's most serious deficiency. However, the illustrations and indices to common names and scientific names will aid identification.

Ranges of many species of broad distribution might have been stated more precisely by physiographic or vegetation zones, such as the seven numbered plant areas of the *Catalogue of the Flora of Texas* by V. L. Cory and H. B. Parks.

Nearly all the illustrations, about 1,200, are by Sarah Kahlden Arendale. These beautifully executed though heavily shaded line drawings mostly fall below the usual botanical standards, being reduced somewhat and without scales. Branching twigs, many leaves, and many flowers or fruits often are shown. Smaller drawings with fewer parts on a larger, exact scale indicated by fraction of natural size and with flower details often enlarged would have served better for identification. Many shrubby species probably have not been illustrated before.

ELBERT L. LITTLE, JR.
Forest Service, U. S. Dept. Agric.
Washington, D. C.

Manual of Photographic Interpretation

Edited by Robert N. Colwell. 868 pp. Illus. American Society of Photogrammetry, Washington, D. C. 1960. $15.

Since the compilation and writing of this manual involved the participation of 16 individual chapter author-editors and some 80 contributing authors, its publication per se represents quite a remarkable feat. That it is also of excellent quality bears additional testimony to the editorial genius of Professor Colwell of the University of California.

Few techniques have such increasingly wide application to various land management and earth science professional activities as has aerial photo interpretation. Consequently, serious students of this science, both generalists and subject matter specialists, are multiplying in numbers and in desire for information. For the most part, the various specialized groups have based their particular developments and applications upon a common set of concepts, theories and basic techniques. As a result, many local developments in photo interpretation have come about which could find use in other areas and professional fields. A major problem, however, has been that of obtaining an interchange of information within and between various groups such as forestry, soils, geology, and others. Much of the available pertinent literature is either so localized in nature or scattered through such a variety of professional journals, texts, and other media as to make their location and summary by an individual a virtually impossible task. This manual has, therefore, performed a considerable service in bringing the principal disciplinary groups together in a well-organized presentation of their individual current photo interpretation literature and ideas.

The manual is comprised of 16 chapters, 3 of which involve these basic areas: Development of Photo Interpretation, Procurement of Aerial Photography, and Fundamentals of Photo Interpretation. The latter chapter is felt to be particularly interesting in that it presents in readable terms one of the first really thorough and authoritative discussions of visual factors and human requirements in photo interpretation. The remaining 13 chapters are concerned with the following subjects: Geology, Soils, Engineering, Forestry, Wildlife Management, Range Management, Hydrology and Watershed Management, Agriculture, Urban Area Analysis, Archeology, Geography, Special Forms (e.g., photomicrography), and Education and Training.

Of immediate interest to foresters is the chapter on Forestry developed by author-editor Richard C. Wilson with the assistance of 12 contributing authors. As are the other portions of the manual, this chapter is profusely illustrated with both black and white and some unusually good color stereograms of different film-filter-season combinations, photo interpretation aids, forest vegetation classification systems, fire and insect damage, reforestation and recreation planning. In the text, both qualitative and quantitative characteristics of photo images are discussed as are such topics as forest classification, volume inventory, timberland appraisal, sale and exchange of timber, forest roads, forest soils, protection, reforestation, and recreation. The chapter is clearly written and well-documented with a bibliography of over 100 literature citations. Of equal interest to the majority of forest photo interpreters will be the chapters on Range, Wildlife, and Watershed Management which follow it.

A major value of the manual is the availability of written and pictorial comparisons of photo interpretation use in different areas of resource management and analysis. Many foresters will, therefore, find much information of interest and value in portions of the manual other than those already described. Of particular note are the chapters on Geology, Engineering, Soils, and Agriculture, all of which are well illustrated and quite understandably written.

Although information of an elementary nature is included in the manual, it is by no means primarily designed as a text for training the beginner in photo viewing and photo reading. It is in addition a most valuable reference text for the more advanced student, the educator, and for the practicing forest photo interpreter.

Merle P. Meyer
University of Minnesota, St. Paul.

This is the American Earth

By Ansel Adams and Nancy Newhall with an introduction by David Brower. 89 pp. Illus. The Sierra Club, San Francisco, Calif. 1960. $15.

Typographically, this is doubtless one of the most beautiful books of the year 1960. In general, the illustrations, particularly the photographs by Ansel Adams, are handsomely reproduced with a technical quality that is superb.

To a reviewer who loves books for their own sake, the first, almost irresistible, impulse is to acclaim it uncritically for the thing of beauty that it is. One turns to a double-page spread (and mind you, each page is a large 13½ by 10¼ inches) such as "Aspens, New Mexico," and the evocation of dark woods, bright tree boles, and shimmering leaves is like a spiritual uplifting.

In four decades of book reviewing I have never approached an assignment with such a preconceived attitude of enthusiastic approval. Hardly had I turned the first few pages than I was ready to give unstinted praise. Sumptuousness combined with impeccable taste is worthy of applause whenever encountered, especially in books on natural resources. This one is no exception. And yet . . .

Keeping in mind that the title is *The American Earth,* one wonders about the inclusion of such extraneous subjects as famine in India, ancient Asiatic ruins, New York city slums, bathers on the Ganges. Can it be that these, and other extrinsic photographs, were introduced to illustrate the text? If so, then a critical examination of the text is in order.

Normally, in book production, the illustrations are primarily to explain or adorn the text. In this case, however, it would appear that the pictures were intended to have prominence or at least equality with the editorial content.

Frankly, the imbalance between text and illustrations is evident and unfortunate. However sincere her intentions, the writing does not come off. In part prose poetry, in part blank verse, it attempts to tell the history of land use in a manner that is emotionally exaggerated and at the same time pretentiously literary.

For example, she writes:

From Europe, where, since before Columbus, nations in dire need
had been planting forests, Gifford Pinchot brought the concept of perpetual yield;

how resources we considered wild—timber, wildlife, pasture, fish—

could be farmed, increased, improved for use forever.

For this concept he fought to open all closed forests and inviolate parks.

This may be poetic license, but it is bad history. The concept of "perpetual yield" was brought to America long before Mr. Pinchot's time—by B. E. Fernow and J. T. Rothrock, among others. Moreover, Mr. Pinchot never "fought to open closed forests and inviolate parks," assuming that one understands what Miss Newhall is talking about, which is not always easy to do. Having worked for, and with, Mr. Pinchot for nine years, and having been professionally associated with him for a quarter century, I believe I know what his personal attitudes to many conservation issues were. Miss Newhall's assumption is wide of the mark.

A book of less than one hundred pages priced at $15 should not unreasonably be expected to have some special quality that sets it

apart. Admittedly, this volume has. Most of the pictures, notably those by Mr. Adams, are well worth the cost. But the text and some of the other photographs detract rather than enhance the work as a whole.

HENRY CLEPPER

Logging Road Handbook: The Effect of Road Design on Hauling Costs

By James J. Byrne, Roger J. Nelson, and Paul H. Googins. 65 pp. Illus. USDA Handbook No. 183. Government Printing Office, Washington 25, D. C. 1960. $0.50.

In 1947, Byrne of the Pacific Northwest Forest and Range Experiment Station, with Nelson and Googins, in the U. S. Forest Service Division of Engineering, prepared a report, "Cost of Hauling Logs by Motor Truck and Trailer."

This popular and useful mimeographed publication, which was revised once in 1956, has been further revised and made available in printed form as USDA Handbook No. 183, *Logging Road Handbook: The Effect of Road Design on Hauling Costs.*

I commend this handbook to all interested foresters, engineers, and operators as the most authentic study of the effect of road design on log hauling costs, and a fine complement to Axel J. F. Brandstrom's *Analysis of Logging Costs and Operating Methods in the Douglas Fir Region* (1933) and Donald M. Matthews' *Cost Control in the Logging Industry* (1942).

The new handbook fills a vital need of engineers or others in designing roads to attain the optimum balance between construction and operating costs. The principles described can be used equally well to determine probable hauling costs on existing roads. With the phenomenal progress that has been made in physical methods of road construction, it is appropriate that intensive study be given to logging road design (particularly for the more permanent parts of a system) and its effect on over-all costs.

The *Logging Road Handbook* offers guidance to the road designer by vividly setting out the effects of such factors as favorable and adverse grades, road width, degree of curvature, number of curves per mile, road surface, density of traffic, spacing of turnouts, and visibility on log hauling costs.

Similarly, effects of truck size and horsepower, fuel type, and all types of delays are diagnosed for thoughtful study.

While one might question whether 8 pounds per board foot, Scribner scale, is a proper weight factor for Douglas-fir, an engineer or operator can readily adjust costs to suit his specific conditions of log weight and defect. He can include his own estimated or actual costs of road amortization, maintenance, taxes or special-use fees and use the handbook's guides to complete his estimate of hauling costs.

I compliment the Forest Service and the authors for this excellent contribution to the fields of engineering cost analyses and economic design of logging roads.

ED P. STAMM
Crown Zellerbach Corp., Portland, Ore.

Careers and Opportunities in Science

By Philip Pollack. Rev. ed. 194 pp. Illus. E. P. Dutton & Co., Inc., New York. 1960. $3.95.

Despite the sophistication of adolescents along some lines, choosing a career for many young people is filled with frustration and indecision. Too often the choice is rather casual. A decision may be made after completing an enjoyable high school course, by following the steps of a family friend whom one admires, or from the romantic world of movies or TV, without real knowledge of the requisites for success in a given field of work, the duties and responsibilities, and rewards.

This book describes careers in science in language young people can understand. It can encourage and stimulate them. The accomplishments and problems that faced great scientists make fascinating reading.

The reader is reminded that the vast achievements of science resulted not because of science in the abstract but because of flesh-and-blood people. A few are famous geniuses but most men and women scientists are less prominent, possessing varying degrees of talent. In shaping our modern age through scientific accomplishment career opportunities were created, unknown to even recent generations. In this book science is synonymous with scientific research and basic research. The importance of the applied fields is recognized because "science wedded to technology has given birth to a bewildering procession of discoveries and inventions." The cumulative product of research in the last twenty-five years alone is astonishing and shows that mankind is at the threshold of a new age for which no precedents exist. The impressive growth of industrial research laboratories and budgets for research and development indicate that entire new industries may rest on a single new idea or formula.

The traits and qualities that make up a successful scientist are well presented: enthusiasm, perseverance, openmindedness, imagination, insight, originality, cooperativeness, and the more formal qualifications including a sound background in mathematics. To be successful, the scientist need not be a mental giant but a reasonable degree of intelligence is required. Most important, one must be genuinely happy doing research and enthusiastic about the problem on which he is working.

Mr. Pollack writes with ease and authority on the physical sciences: chemistry, physics, atomic energy, and geology. He does a creditable job on careers in biology and medical research, but he must have been in strange territory when he plunged into the chapter "Biological Careers in Conservation."

Although careers in forestry research might be appropriate, forestry in general and the other

careers in applied science seem out of place in a book otherwise devoted to basic sciences. Practicing physicians are excluded on this score and engineering is covered in another book by the author, *Careers and Opportunities in Engineering*. Other careers in conservation discussed include those in soil conservation, agronomy (in connection with the Soil Conservation Service), wildlife conservation, and entomology.

In appendices, income of workers in scientific fields is compiled along with a list of institutions that offer training in the various sciences. The income statistics, primarily based on Civil Service classifications of the federal government, are not comparable for all fields. Had income been presented by education and length of experience, as it was for physicists, it would have been more meaningful.

We are introduced to foresters by a description of a raging forest fire to which "forest rangers lead fire fighters to the rescue, raking debris, shoveling dirt, and beating down flames." There are knowledgeable statements about what a forester does and about renewable resources, but then a garbled account: "Your first position as a forester, after graduation from a forestry school, would be as an apprentice, probably with the federal or state government, or in a commercial company with large forest holdings, such as a pulp and paper company. You would learn how to identify trees without examining their leaves or branches and how to use surveying instruments. After serving your apprenticeship, you might become a forest ranger, supervisor, instructor in a college of forestry, or assistant to a project leader in research. You might eventually be promoted to the position of supervisor of a national forest, to a post as a consulting forester, or even to a higher management job. Top positions in forestry are those of state foresters, United States forester, director of a forest experimental station, chief of the United States Forest Service, or professor or dean at a college of forestry."

The vocational aspects of forestry are emphasized. A picture of a forester at work shows one in a western hat scaling logs on the Fayette (*sic*) National Forest, Idaho. "The wives of foresters must be reconciled to periodic separations from their husbands; they must often live in the back country under primitive conditions. . . . In spite of these drawbacks many young men who love working in the out-of-doors prefer forestry as a career." The author obviously is far afield, possibly attempting to digest publications in part outdated.

He makes some factual errors too: "In 1950, 20,821 forestry degrees were granted" (instead of 2,321). "Private corporations such as lumber companies and pulp and paper manufacturers own about two-thirds of all forest land" (actually 13 percent of the commercial forest land). And ". . . soil on the slopes of the valley had been burned out by fire." Condensed descriptions, such as one concerning the training of foresters, result in distortion: "The first two years of the undergraduate courses are devoted to chemistry and biology; the next two years to silviculture (the study of forests and forest trees), forest management, lumbering, range management, entomology, dendrology and forest economics."

Aren't we past the stage where we should feel complimented because a career book mentions forestry, one in which foresters are grossly misrepresented? Let's hope that Mr. Pollack seeks a collaborator before he undertakes the next revision of his book.

Richard C. Smith
School of Forestry, University of Missouri, Columbia

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The Ball-Hooter

By Howard A. Hanlon. xiv+368 pp. Illus. Prospect Books, Prospect, N. Y. 1960. $4.50.

By tying together true historical events and developments with a fictitious lumberjack and members of his family and acquaintances, a fascinating story has evolved. This is not a textbook, history, or fiction, but a combination of all three.

The association of incidents and conditions in and around logging and milling operations brings to the reader a vivid, colorful and realistic picture of life in the heyday at the turn of the century and throughout the era of the early 1900's. The historical background has been authentical and is based on the area of southern New York, Pennsylvania, and West Virginia. The same conditions were found in the logging areas of Michigan, Wisconsin, and Minnesota in the early days and when reading the book the reviewer could draw many analogies with his own youthful experiences in logging life.

For people that have not been fortunate enough to live in the era of the book, it is a real education to read about the life of people who helped to cut our virgin forests. Many of the terms used are strict lumberjack parlance and vividly express the subject or conditions. Any student of forestry should read this book to become acquainted with the historical development of one of the major lumber producing areas. The transition from pine to hemlock, to hardwood, to burned-over lands and back to forest is a part of the story.

Many illustrations are included to give the reader a picture of the conditions described.

While some of the characters are fictitious, a great many were true living people. The book is not written as a fiction novel and does not read as a novel, yet there is an easy flow in reading. Most of the basic story is tied in chronologically with the growth of the lumber industry or possibly the harvesting of the old stand timber.

The author has done a great job of bringing together historical facts which must have required a lot of research.

The final chapters draw a comparison between the era written about and our present day. Many of the names found in the early logging days are still found in the lumber business.

Orvel A. Schmidt
The Pennsylvania State University, University Park

Current Literature

Compiled by LOIS MCALLISTER, *Assistant Librarian, State University College of Forestry at Syracuse University*
Range Management Section Compiled by NELLIE G. LARSON, *Library, U. S. Department of Agriculture*

General

Cultivated Palms. Edited by R. B. Ledin. 189 pp. Illus. American Horticultural Society, Washington 2, D. C. 1961. Special issue of The American Horticultural Magazine. $3.

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Trees and Bushes in Wood and Hedgerow. By Helge Vedel and Johan Lange. Translated by C. H. R. Hillman. 224 pp. Illus. Methuen and Co., Ltd., London WC 2. 1960. Approx. $2.75.

Farm Forestry

Special Problems of Small Forest Owner in United States. By L. I. Barrett. 21 pp. U. S. Forest Service, Washington 25, D. C. 1960. Paper, 5th World Forestry Congress, Seattle, Wash. August 29-September 10, 1960.

Forest Influences

Assistance for New Jersey Land Owners —Watershed Protection, Flood Prevention. By R. M. Hanna. 16 pp. Rutgers—The State University, College of Agriculture, Extension Serv., New Brunswick, N. J. 1960. Ext. Bul. No. 339.

Research Outlook on Soil, Water and Plant Nutrients; Proceedings of the Eighth Annual Meeting of the Agricultural Research Institute, October 12-13, 1959. 103 pp. National Academy of Sciences—National Research Council, Washington 25, D. C. 1960.

The Utilization of Timber Resources in the Watersheds of the State; Final Report of the State Development Committee. 67 pp. Illus. Commonwealth of Australia, State of Victoria, Melbourne. 1960. Approx. 50 cents.

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Working Plan for the Kibale and Itwara Forests; First Revision, Period 1959 to 1965. By H. A. Osmaston. v.p. Illus. Uganda Protectorate, Forest Dept., Entebbe, Africa. 1959.

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Forest Regions of United States [Map]. Rev. 1 p. U. S. Forest Service, Washington 25, D. C. 1960. 10 cents (Govt. Print. Off.)

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Gum Diseases of Citrus in California. Rev. By L. J. Klotz. 23 pp. Illus. California Agric. Expt. Sta., Berkeley. 1960. Cir. No. 396.

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An Abstract Bibliography of Statistical Methods in Range and Related Pasture Research. By M. J. Morris. 285 pp. U. S. Forest Service, Biometry Serv. & Div. of Range Mangt. & Wildlife Habitat Res., Washington, D. C. Oct. 1960. In 5 parts: I, Measurement of Vegetation; II, Use of Animals in Measuring Herbage Production; III, Statistical Theory and Method; IV, Forage Analysis; V, Abbreviations for Titles of Publications.

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California Public Outdoor Recreation Plan. Part 1. 80 pp. Illus. California Dept. of Natural Resources, Sacramento. 1960.

Manual for Park and Recreation Boards and Commissions. By E. A. Connell. 40 pp. American Institute of Park Executives, Oglebay Park, Wheeling, W. Va. 1960. $2.

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Planting Sitka Spruce and Douglas-Fir on Decayed Wood in Coastal Oregon. By C. M. Berntsen. 5 pp. Illus. Pacific Northwest Forest and Range Expt. Sta., Portland, Ore. 1960. Research Note No. 197.

Seven Years Later; Effects of Wildfire in Young Stand of Virginia Pine and Hardwoods. By R. H. Fenton. 4 pp. Northeastern Forest Expt. Sta., Upper Darby, Pa. 1960. Forest Research Note No. 100.

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Thermal Expansion of Free Films of House Paint. By F. L. Browne. 10, [6] pp. Tables. U. S. Forest Products Laboratory, Madison 5, Wis. Report No. 2204.

Society Affairs

Officers and Council
1960-1961

CHARLES A. CONNAUGHTON, *President*
U. S. Forest Service
630 Sansome Street
San Francisco 11, Calif.

B. E. ALLEN
Union Bag-Camp Paper Corp.
P. O. Box 570
Savannah, Ga.

WILLIAM C. BRAMBLE
Department of Forestry and Conservation
Purdue University
Lafayette, Ind.

DONALD E. CLARK
U. S. Forest Service
Federal Center, Building 85
Denver 7, Colo.

HENRY J. MALSBERGER, *Vice President*
Southern Pulpwood Conservation Association
900 Peachtree Street, N.E.
Atlanta 9, Ga.

KENNETH P. DAVIS
School of Natural Resources
University of Michigan
Ann Arbor, Mich.

GEORGE A. GARRATT
School of Forestry
Yale University
New Haven 11, Conn.

WILLIAM D. HAGENSTEIN
Industrial Forestry Association
1410 S.W. Morrison Street
Portland 5, Ore.

HENRY CLEPPER, *Executive Secretary*
Mills Building, 17th Street at Pennsylvania Avenue, N.W.
Washington 6, D. C.

SVEND O. HEIBERG
College of Forestry
State University of New York
Syracuse 10, N. Y.

RICHARD J. PRESTON, JR.
School of Forestry
North Carolina State College
Raleigh, N. C.

CHARLES L. TEBBE
U. S. Forest Service
Federal Building
Missoula, Mont.

Committees Formed for Joint SAF-CIF 1961 Meeting

On February 2 there was held at the University of Minnesota, St. Paul, a meeting of the various committees that will be responsible for the joint 1961 annual meeting of the Society of American Foresters and the Canadian Institute of Forestry.

The meeting will be held in Minneapolis at the Leamington Hotel. The dates are October 8-11.

The committees for the meeting, together with their chairmen, are as follows:

General chairman (SAF), Frank H. Kaufert, University of Minnesota School of Forestry, St. Paul 1, Minn. Co-chairman (CIF), George R. Sonley, Marathon Corporation of Canada, Ltd., P. O. Box 1140, Port Arthur, Ontario.

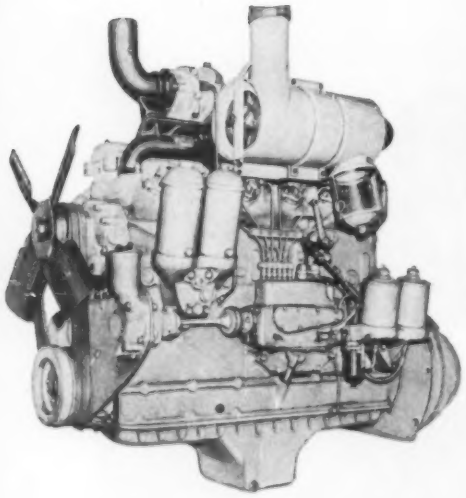
Chairman of the Program Committee (SAF), George Amidon, Minnesota & Ontario Paper Company, International Falls, Minn. Co-chairman (CIF) A. S. Bray, Ontario Department of Lands and Forests, Port Arthur, Ontario.

L to *R*, Frank H. Kaufert, general chairman; M. B. Dickerman, chairman, Committee on Arrangements; Frank Frederickson, chairman of the Upper Mississippi Valley Section.

NEW International® TD-

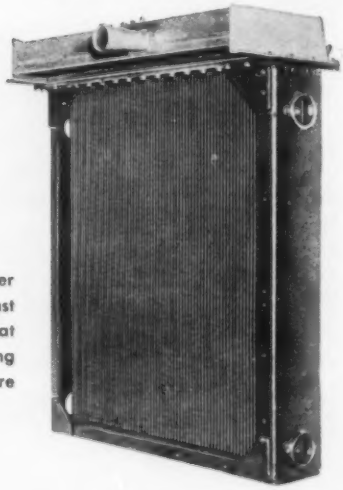
...built to "BEEF UP" your profit edge!

From air intake to new fixed drawbar—from day-to-day dependability through year-in, year-out durability—new strength, new performance protection, new work capacity are built into the new TD-20. Check and compare the advantages of International turbocharged Diesel power, teamed with beefed-to-match new transmission and final drive components—platformed on a far stronger-than-ever undercarriage—turned into new efficiency by International-built tracks, kept in life-prolonging alignment by exclusive International 3-point suspension. See your International Construction Equipment Distributor for a new TD-20 demonstration.



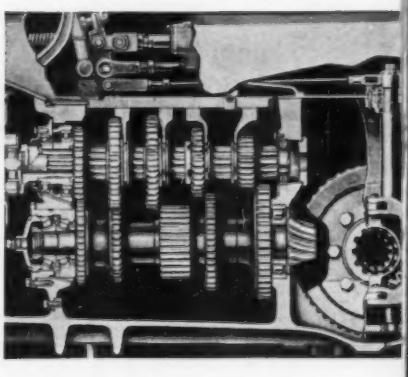
New Turbocharged Diesel Wallop

Modern turbocharging crams air into the new TD-20's smooth running 6-cylinder engine—to produce extra hp efficiently at all altitudes; and to give a 50% torque rise to lug larger overloads. Crankcase ribs are "beefed up;" cooling, air cleaning, and crankshaft capacity all are increased to team with turbocharging. Push-button TD-20 starting is by famous International gasoline-conversion system!



Larger radiator plus jet head increases cooling capacity

Coolant, under pressure from the new greater capacity radiator, is shot through jets against lower surface of TD-20 heads—to aid heat transfer and avoid build-up of heat-trapping deposits. Fan shroud and radiator guard are "heavied" for increased rigidity.



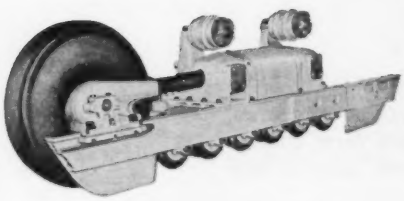
New transmission capacity ...New filtering system added

Heavier shafts, more rugged gears, and roller bearings of greater capacity are provided—to carry increased hp and add thousands of hours to working life of power train components. New transmission oil pump circulates and filters life-guarding lubricant. New "short-travel" levers add operating ease.

-20

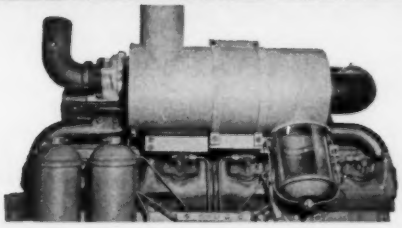
(201 SERIES)

New 140-hp International TD-20 crawler tractor. Develops 113 drawbar hp. Powered by 6-cylinder DT-691 Turbocharged Diesel engine. New capacity 6-speed, full-reverse transmission is controlled by new short-travel gear-shift and Shuttle-Bar levers.



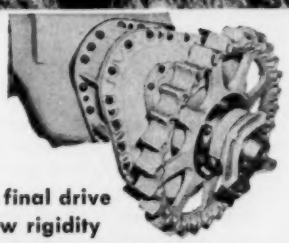
New Undercarriage Strength and Protection

New drum-type front idlers add strength... International also adds track chain guides to both sides of the TD-20's precision-welded double box-beam track frames! New track roller shields are of cast steel. New heavier strutless track links are self-cleaning and power-saving. The new hydraulic track adjuster, with built-in safety relief is "standard" on the new TD-20. And full-floating seals of increased efficiency guard Dura-Roller life!



New 99.8% efficient Dry-Type air cleaner

For positive "breathing" safety, the full air volume taken in by turbocharging is "dry-cleaned" of 99.8% of its dirt—by the TD-20 Diesel's new dry-type air cleaner. Handy, under-hood horizontal mounting—and transparent, quick-dump collector—greatly simplify servicing. Dash indicator shows "red" when cleaner element needs washing.



New final drive ...new rigidity

New TD-20 final drives have been strengthened to deliver full torque turbocharged power to the tracks. New sprocket drive doweling increases housing rigidity—helps maintain precision component alignment. Other major steps ahead in TD-20 design include: new torque-taking, life-adding bimetallic steering clutch discs; new pivot shaft inner spacer; new hardness of sprocket drive pinion shaft.

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A COMPLETE POWER PACKAGE

L to *R*, George Amidon, chairman of the Program Committee; Henry Clepper, SAF executive secretary; and George R. Sonley of Ontario, general co-chairman for the CIF.

Chairman, Committee on Arrangements, M. B. Dickerman, Lake States Forest Experiment Station, St. Paul 1, Minn. Vice chairman, D. P. Duncan, School of Forestry, University of Minnesota, St. Paul 1, Minn.

Chairman, Committee on Information and Publicity (SAF), James T. Morgan, Lake States Forest Experiment Station, St. Paul 1, Minn.

Chairman, Committee on Hotel Reservations and Housing, Clarence Eggen, Bureau of Indian Affairs, 2908 Colfax Avenue South, Minneapolis 8, Minn.

Chairman, Committee on Meeting and Conference Rooms, R. M. Brown, School of Forestry, University of Minnesota, St. Paul 1, Minn.

Committee on Registration and Welcome, Earl Adams, Minnesota Department of Conservation, Division of Forestry, State Office Building, St. Paul, Minn.

Committee on the Annual Dinner, Sidney Weitzman, Lake States Forest Experiment Station, St. Paul 1, Minn.

Chairman, Committee on Projection and Amplifying Equipment, Marvin Smith, University of Minnesota Extension Service, St. Paul 1, Minn.

Chairman, Committee on Exhibits, W. R. Miles, School of Forestry, University of Minnesota, St. Paul 1, Minn.

Chairman, Committee on Field Trips, Frank Frederickson, Minnesota & Ontario Paper Company, International Falls, Minn.

Chairman, Committee on Ladies Activities, Mrs. M. B. Dickerman, 1538 Grantham Street, St. Paul 8, Minn.

Additional information about the meeting will be published in subsequent issues of the JOURNAL.

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If you change your address please notify the JOURNAL OF FORESTRY, preferably in advance, by letter, post card, or post office form number POD 3573. Be sure to give your old, as well as the new, address with your postal zone number if any.

You should also notify your local post office on postal form number POD 3575 of your change of address. Both postal forms are obtainable at any post office.

Copies of the JOURNAL will not be forwarded by the Post Office Department. Hence, in order to avoid missing your copy as well as to prevent extra expense to the Society in supplying duplicates, you are urged to notify the JOURNAL as soon as you know your new address, a month in advance of change if possible.

JOURNAL OF FORESTRY
425 Mills Building
17th Street at Pennsylvania Avenue, N. W.
Washington 6, D. C.

Third Call for Council Nominations

All members are hereby notified that the regular biennial election will be held December 2, 1961. A president, vice president, and nine other members of the Council will be elected for the two-year term 1962-1963.

The present Council is listed in the box on page 305. Any or all of these incumbents may be renominated, provided they accept the nomination in writing.

Membership on the Council is restricted by the Constitution to Members (formerly Senior Members) and Fellows. Any Member or Fellow is eligible to hold office who is in good standing and who accepts the nomination in writing and declares his willingness to serve if elected.

Each voter will have an opportunity to ballot on all candidates for office. Council members are elected in accordance with the system of proportional representation. The procedure of proportional representation will be explained in a later issue of the JOURNAL. It is the system by which the Society has been electing Council members for more than two decades.

Candidates for the office of president are voted on separately; the candidate who receives the highest vote is declared elected president, and the candidate who receives the next highest vote is declared elected vice president. Thus all candidates for president are considered as nominated also for vice president.

How Nominations Are Made

The Constitution (Article VIII, Section 2) states the conditions under which nominations are made by petition.

1. Each petition shall name but one candidate.

2. All candidates must be eligible to hold elective office.

3. A petition shall bear the signatures of at least ten voting members who at the time of signing the petition are eligible to vote in the coming election. (Eligible voting members are Junior Members, Members, and Fellows in good standing.)

4. A voting member may not sign more than one nominating petition for president or more than one nominating petition for a member of the Council. That is, he may sign two, but no more.

5. Petitions must be in the Society office by September 16, 1961.

The Society has no special form for submitting nominating petitions. They may be written as follows:

We, the undersigned voting members of the Society of American Foresters, hereby nominate John Doe, a Member (or Fellow) for the office of president (or member of the Council) for the two-year term 1962-1963.

The form of acceptance of a nomination may read as folows:

I accept the nomination to the office of President (or to membership on the Council) of the Society of American Foresters for the two-year term 1962-1963, and agree to serve if elected.

No nomination will be considered valid unless supported by the nominee's acceptance in writing which should be attached to the nominating petition.

All nominating petitions should be sent promptly to the Society office, 425 Mills Building, 17th Street at Pennsylvania Avenue, N. W., Washington 6, D. C. The executive secretary will gladly provide information about nominating or election procedure.

According to the Constitution (Article VIII, Section 1) a Nominating Committee has been appointed by President Connaughton.

This committee is charged with the following duties:

1. To set the date of the election. (December 2, 1961, is the date.)

2. To provide for at least two candidates for the office of president, and at least nine candidates for membership on the Council.

3. To receive separate nominating petitions for the office of president and for each member of the Council, and to supplement such petitions when necessary with other nominations in order to comply with item 2 above.

The Nominating Committee will make no nominations of its own unless the voting membership fails to make the required minimum number of nominations by petition. Voting members should accordingly get busy and make their own nominations. For their information the distribution of Council members by states during the period 1946-1961 is shown in Table 1, page 143, February issue.

Nominations Received

On the date of going to press the following nominations had been received:

For President

B. E. Allen, Savannah, Ga. (Council Member 1956-1957, 1958-1959, 1960-1961.)

Paul M. Dunn, New York, N. Y. (Council Member 1946-1947, 1948-1949.)

J. Herbert Stone, Portland, Ore. (Council Member 1954-1955, 1956-1957, 1958-1959.)

For the Council

W. D. Hagenstein, Portland, Ore. (Council Member 1958-1959, 1960-1961.)

George M. Jemison, Washington, D. C.

William A. Parr, Bel Air, Md.

Archie E. Patterson, Athens, Ga.

Burnett H. Payne, San Francisco, Calif.

SETH G. HOBART, *Chairman*
Nominating Committee

Southern Forest Tree Improvement Conference

The Sixth Southern Forest Tree Improvement Conference will be held at the University of Florida, Gainesville, June 7-8, 1961.

Third Call for Fellow Nominations

All members (formerly Senior Members) and Fellows of the Society are hereby advised that nominations for the grade of Fellow are now open. The election of Fellows will be held at the time of the Society's regular biennial election, December 2, 1961.

As defined by the Constitution (Article III, Section 7), "Fellows shall be foresters recognized generally throughout the profession as persons who have rendered outstanding service to forestry and to the Society. They shall be elected from the Members."

Nominations by Petition

The procedure for placing Members in nomination for the grade of Fellow is by petition. The Society has no printed form for this purpose; the petition may be typewritten thus:

We, the undersigned Members and Fellows of the Society of American Foresters hereby nominate John Doe for election to the grade of Fellow in 1961.

Remember these simple rules:

1. A petition may not name more than one nominee.

2. It must be signed by not less than 25 Members or Fellows in good standing.

3. It must be accompanied by a factual, not eulogistic, biographical sketch of at least 300 words giving an account of the nominee's professional career and accomplishments.

4. It must be received in the executive office of the Society, 425 Mills Building, 17th Street at Pennsylvania Avenue, N.W., Washington 6, D. C., not later than September 16, 1961.

The executive employees of the Society cannot be responsible for obtaining signatures on partially completed petitions or on petitions incomplete by reason of unacceptable signatures (that is, signatures of other than Members and Fellows in good standing). Only those nominees' names will appear on the ballot whose petitions are complete and valid in all details as of September 16, the closing date.

Election Procedure

Fellows are not elected by the membership at large, but by a board of electors which consists of all present Fellows, the Council, the chairmen of the 22 Sections, and the chairmen of the 10 subject Divisions.

The system is described in Article IV, Section 4 of the Constitution. To win election a nominee must receive an affirmative vote of not less than one-half the total number of votes cast, as provided in Bylaw 11.

For the 1961 election there will be 135 electors, of whom 94 are Fellows. An elector has one vote only. Thus, a Fellow who is also a Council member has but one vote.

Significance of the Grade

The highest membership distinction that can be conferred by the Society, this grade is awarded in recognition of outstanding service to forestry and to the Society. Fellows do not pay increased dues; their dues are the same as those of Members.

Since the Society was founded in 1900, there have been 125 Fellows elected. At the present time the number of living Fellows is 94.

The current roster of Fellows, showing the state in which each is domiciled and the year of his election was published in the February issue, page 145.

Nominations Received

On the date of going to press the following nominations for Fellow had been received:

Frank A. Albert, Jacksonville, Fla.

Robert S. Campbell, New Orleans, La.

Walter H. Horning, Washington, D. C.

George M. Jemison, Washington, D. C.

William M. Oettmeier, Fargo, Ga.

Coming Events

To Hold Joint Meeting

The Inland Empire Section of the Forest Products Research Society and the Northwest Wood Products Clinic will hold their annual combined meeting at the Davenport Hotel, Spokane, Wash., April 11-12, 1961.

New York Section

The New York Section will meet April 11 and 12 in conjunction with the celebration of the 50th anniversary of the College of Forestry, Syracuse, N. Y.

Puget Sound Section

The Puget Sound Section will hold its annual meeting on April 28-29, 1961, at the Morck Hotel, Aberdeen, Wash.

Columbia River Section

The Columbia River Section will hold its annual meeting May 5-6, 1961, at the Marion Hotel, Salem, Ore.

Gulf States Section

The Gulf States Section will hold its annual meeting at the Edgewater Gulf Hotel, Edgewater Park, Miss., May 8-9, 1961.

Colleges and Universities in the United States Offering Instruction in Forestry (January, 1961)

Accredited

The following institutions are accredited for forestry instruction by the Council of the Society of American Foresters.

Auburn University, Department of Forestry, Auburn, Ala.

University of California, School of Forestry, Berkeley 4, Calif.

Colorado State University, College of Forestry and Range Management, Fort Collins, Colo.

Duke University, School of Forestry, Durham, N. C.

University of Florida, School of Forestry, Gainesville, Fla.

University of Georgia, School of Forestry, Athens, Ga.

University of Idaho, College of Forestry, Moscow, Idaho.

Iowa State University, Department of Forestry, Ames, Iowa.

Louisiana Polytechnic Institute, Department of Forestry, Ruston, La.

Louisiana State University, School of Forestry, Baton Rouge 3, La.

University of Maine, School of Forestry, Orono, Maine.

University of Massachusetts, Department of Forestry and Wildlife Management, Amherst, Mass.

Michigan College of Mining and Technology, Department of Forestry, Houghton, Mich.

Michigan State University, Department of Forestry, East Lansing, Mich.

University of Michigan, School of Natural Resources, Ann Arbor, Mich.

University of Minnesota, School of Forestry, St. Paul 1, Minn.

University of Missouri, School of Forestry, Columbia, Mo.

Montana State University, School of Forestry, Missoula, Mont.

University of New Hampshire, Department of Forestry, Durham, N. H.

State University of New York, College of Forestry, Syracuse 10, N. Y.

North Carolina State College, School of Forestry, Raleigh, N. C.

Oregon State College, School of Forestry, Corvallis, Ore.

Pennsylvania State University, School of Forestry, University Park, Pa.

Purdue University, Department of Forestry and Conservation, Lafayette, Ind.

Utah State University, College of Forest, Range and Wildlife Management, Logan, Utah.

University of Washington, College of Forestry, Seattle 5, Wash.

West Virginia University, Division of Forestry, Morgantown, W. Va.

Yale University, School of Forestry, New Haven 11, Conn.

Not Accredited

The following institutions offer professional curricula in forestry, but do not meet the requirements for accreditation.

Arkansas Agricultural and Mechan-

ical College, Department of Forestry, College Heights, Ark.

Arizona State College, Department of Forestry, Flagstaff, Ariz.

Stephen F. Austin State College, Department of Forestry, Nacogdoches, Texas.

Clemson Agricultural College, Department of Forestry, Clemson, S. C.

University of Connecticut, Department of Forestry and Wildlife Management, Storrs, Conn.

Harvard University, Harvard Forest, Petersham, Mass.

Humboldt State College, Forestry Department, Arcata, Calif.

University of Illinois, Department of Forestry, Urbana, Ill.

McNeese State College, Department of Plant Science, Lake Charles, La.

Mississippi State University, School of Forestry, State College, Miss.

Oklahoma State University, Department of Forestry, Stillwater, Okla.

University of the South, Forestry Department, Sewanee, Tenn.

Southern Illinois University, Department of Forestry, Carbondale, Ill.

Virginia Polytechnic Institute, Department of Forestry and Wildlife, Blacksburg, Va.

Washington State University, Department of Forestry and Range Management, Pullman, Wash.

Introductory, Preforestry, and Specialized Courses

Abraham Baldwin Agricultural College, Tifton, Ga.

University of Arizona, Department of Watershed Management, Tucson, Ariz.

University of Arkansas, Department of Horticulture, Fayetteville, Ark.

Centenary College of Louisiana, Department of Biology, Shreveport, La.

Cornell University, Department of Conservation, Ithaca, N. Y.

Grand Rapids Junior College, Grand Rapids, Mich.

Idaho State College, Pocatello, Idaho.

University of Kentucky, Department of Forestry, Lexington, Ky.

Lassen Junior College, Division of Vocational Forestry and Lumbering, Susanville, Calif.

Marlboro College, Marlboro, Vt.

University of Maryland, Department of Horticulture, College Park, Md.

Nichols Junior College, Dudley, Mass.

North Central School of Agriculture, Grand Rapids, Minn.

North Dakota Agricultural College, Department of Horticulture and Forestry, Fargo, N. Dak.

North Dakota School of Forestry, Bottineau, N. Dak.

Northern Michigan College, Department of Conservation and Forestry, Marquette, Mich.

Northwestern State College, Agriculture Department, Natchitoches, La.

Ohio State University, Department of Horticulture and Forestry, Columbus 10, Ohio.

Oshkosh Institute of Technology, Oshkosh, Wis.

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WORKBOOK FOR WOODY PLANTS

James W. Hardin, North Carolina State College

This workbook emphasizes the morphology of woody plants and the relationships of families and genera as well as identification. Such topics as the writing of keys, variability of characters and phylogenetic classifications are included, making the workbook a complete study of woody plants. It is usable in any area of North America, and general geographic distribution is given for each species. Summer and winter keys to selected genera are given.

1960; 8½ x 11"; 134 pages; spiral bound; illustrated; $3.50

• • •

ILLUSTRATED GENERA OF WOOD DECAY FUNGI

Charles L. Fergus, Pennsylvania State University

Since the economic importance of wood decay fungi is so great, this manual has been prepared to help the general forester identify such fungi and thus determine the extent of wood decay. The keys in this manual are based on those developed by the late Dr. L. O. Overholts for use in a course in Forest Pathology. They have been changed and expanded to accommodate new genera and changes in nomenclature. Illustrations of each genus are included.

1960; 8½ x 11"; 135 pages; spiral bound; 108 photos; $4.00

FOREST ENTOMOLOGY

T. O. Thatcher, Colorado State University

This book presents a practical approach to teaching the forestry aspects of entomology to students who intend to become professional foresters. It is designed to give sufficient detailed background in insect structure, development and behavior so the practicing forester can recognize and evaluate activity of at least the family groups of insects he will most likely encounter. The keys are illustrated to help in making decisions and are prepared mostly with non-technical terms. The forester will find it a handy reference in the office, laboratory and field.

Available April 1961; 5½ x 8½"; sewed paper cover; illustrated; $4.50

• • •

LABORATORY EXERCISES IN FOREST ENTOMOLOGY

T. O. Thatcher, Colorado State University

Exercises in this manual are designed specifically to accompany the author's book *Forest Entomology*, for use in teaching students who intend to become professional foresters.

Available April 1961; 8½ x 11"; 42 pages; spiral bound; illustrated; $1.65

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University of Rhode Island, Forestry Department, Kingston, R. I.

Rutgers University, Department of Forestry, New Brunswick, N. J.

University of Tennessee, Department of Horticulture and Forestry, Knoxville 16, Tenn.

Texas A & M College, Department of Range and Forestry, College Station, Texas.

University of Vermont, College of Agriculture, Burlington, Vt.

Wisconsin State College, Botany Department, Superior, Wis.

University of Wisconsin, College of Agriculture, Madison, Wis.

Ranger Schools

State Forest Ranger School of the University of Florida, Lake City, Fla.

State Ranger School of State University College of Forestry, Wanakena, N. Y.

Council's Column

Forestry in an Era of Change and Challenge

We are privileged to live in what is probably the most revolutionary period in the long history of man. Tremendous and rapid changes in science, ethics, government, and all the dominating forces affecting the lives of humans present us with challenges and opportunities undreamed of even a generation ago. Repeatedly our top thinkers tell us that the sum total of human knowledge is doubling every ten years. Consider the implications of this startling statement! The challenge it hurls at each one of us if we are to be competent for positions of leadership within our chosen profession! Think what this implies concerning forestry technologies and the vast changes that can be expected within the next 10 or 20 years!

Developments of the past decade in such areas as electronics, nuclear power, rockets and space exploration have exceeded the wildest dreams of even the comic strip originators. Dare any of us predict what the coming decade may bring in freeing mankind from limitations he has considered insurmountable, or what may be the dangers threatening the very survival of the species? Unlimited power with virtually unlimited production of wealth and goods? Colonization of planets in space? A fantastic increase in populations which many believe a greater threat to mankind than thermonuclear war? These are but a few of the possibilities. What then of the future of forestry in the next 10 to 20 years? It would take a rash man indeed to make specific predictions, and I have no intention of "risking my neck" in this manner. However, there are areas where the impacts of the coming era can be anticipated and which it may be profitable to consider. In my opinion each of the following factors will play a major role in shaping forest policy and practices of the near future:

1. *Increased demand for forest products.*—Forest products are the one crop for which there is no expected surplus in the United States. If the predicted population increase to 100,000,000 materializes by the year 2000, the demand for forest products may well be more than double present production. This should greatly increase the value of forest land and stumpage. If stumpage increases as much in the next 20 years as it has in the last, forest products may be one of the most profitable crops that we can raise on our farms, and we may find many of our better lands producing trees instead of food. Such is already the case in the Po Valley of Italy where hybrid cottonwoods are grown on the most fertile soils of a country unable to supply its people with sufficient food. Any such increase in demand will result in greatly increased intensity of management, and the present major problems of poor productivity of farm woodlands and fire losses will have disappeared for reasons entirely economic.

2. *Scientific advances.*—Research is opening new vistas in all branches of forest production and utilization which will profoundly affect forestry. Genetics, still in its infancy in forestry, is producing trees of superior growth, form, and quality. Unquestionably genetics will move into the area of disease and insect resistance, as it has in field crops, to help solve what is becoming a major forestry problem. May not genetics applied to forest trees produce as far-reaching results as have been achieved with corn, fruit, and tobacco?

Soil science, including moisture relations and fertilization, is just developing in the field of forestry. Silvicides and systemics in insect and disease control may reshape much of the practice of silviculture. New developments in statistical methods and in decision making techniques are revolutionizing forest mensuration and requiring specialized knowledge for those responsible for shaping policy.

Research is producing a great variety of new and improved forest products. The last few years have seen the development of chipboard, the chipping of slabs and waste at lumber mills, and the myriad of new products made from wood and paper.

SWEDISH INCREMENT BORERS

The Swedish Increment Borer is by far the best instrument yet devised to determine the characteristics of standing timber. It is extremely light, small in bulk, handy and portable. It makes the smallest possible hole consistent with the purpose of boring; and materially reduces the expense of boring. It makes for accuracy in observation, since the cores obtained with it are exact and permanent records which may be examined at leisure under the best conditions. No skill is required to operate it.

These increment borers are being used by the Federal and State Forest Services, lumber companies, telegraph and telephone companies, creosoting companies, etc.

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Length of Bore	Instrument Complete each		Bit only		Extractor only	
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8 in.	4333½	24.25	4333½	B	4333½	E
10 in.	4334½	27.35	4334½	B	4334½	E
11¾ in.	4335½	30.65	4335½	B	4335½	E
13¾ in.	4336½	34.00	4336½	B	4336½	E
15¾ in.	4337½	36.60	4337½	B	4337½	E

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It is reasonable to presume that even more startling achievements may be just ahead. Coupled with these rapid developments is the increasingly important problem of obsolescence, lost markets, and the threat of new synthetic materials. Picture the possibility of a synthetic, petroleum-based fiber replacing wood fiber in the paper industry and its direful effect on forestry, or conversely consider how effective dimensional stabilization of wood might increase demand.

3. *Mechanization.* — Mechanization has had a profound effect on forestry in the last decade in land clearing, fire fighting, reforesting, harvesting, hauling and manufacturing. There has been amazing progress in new and improved machinery. Each year finds less place for cheap, unskilled labor and a reduction in the hard, physical labor that formerly characterized work in the woods. Chain saws, mechanical loaders, gang saws, heavy tractors, radio, aircraft, and new fabricating machines have been revolutionizing forestry. Already present are fantastic new machines which are clearing jungles, harvesting forests, and manufacturing complex products with a minimum of manpower.

As labor costs increase we can expect even more fantastic equipment and a development in automation to parallel that already achieved in some of the metal-working plants.

4. *Leisure time.*—Each year Americans have more leisure time and more income to spend on recreation. In the last nine years the use of forest land for outdoor recreation is said to have increased 400 percent. This increasing recreational use of the forests often conflicts with use for production of forest products and will become an increasingly severe problem as population pressures mount. The resolution of the conflicting interests of the timber grower, hunter, camper, and nature lover is a major problem of the present and future.

5. *Water supply.*—In many areas, even in the humid South, water is fast becoming the limiting factor for economic development. In the not too distant future, our forests may be recognized as being as important for the water they produce as for their wood products. The management of the forests to provide maximum production of timber and water will be a vital factor in future forestry.

6. *Taxes.*—Every facet of our economic life is affected by the tax structure. The future of forestry could be more drastically affected by changes in our tax structure than by any of the other factors we have discussed. Unfortunately any change in tax structure is apt to result in negative returns. Changes are now being considered in capital gains treatment given to timber that could greatly reduce forestry expenditures by large ownerships. County taxes on forest land could well be raised to a point making sound forestry practices unprofitable, in fact, this has happened in areas in the North.

7. *Professional competence.*—The forester of the near future will be required to have a greater degree of competence than is required today. This poses a real challenge to the schools to upgrade their programs. Not only must the teaching profession find a way of including the new horizons and expanding total of human knowledge in the educational program, but it must also give the student a stronger base so that he will have the mental equipment to grasp the increasing complexities of the new technologies and adjust to them. We must raise our sights in our academic standards, in our requirements in the basic sciences, and in the quality of our teaching. Greater emphasis must be given continuing education, to enable the professional man to keep abreast of the steady stream of changes.

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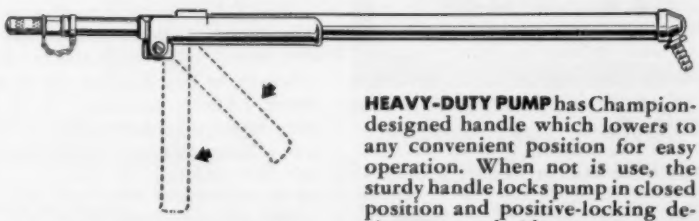

HEAVY-DUTY PUMP has Champion-designed handle which lowers to any convenient position for easy operation. When not is use, the sturdy handle locks pump in closed position and positive-locking device on cover holds pump securely. Pump is brass throughout with non-corroding, self-cleaning bronze ball valves.

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In summation, I am convinced that forestry is on the threshold of tremendous change and development. This will be an exciting period which will offer great challenges and opportunities. Let us hope that we have within our profession the leadership and the courage to meet these challenges.

RICHARD J. PRESTON, JR.

Puget Sound Section, SAF, on Wilderness Areas

Statement of Puget Sound Section, Society of American Foresters, at public hearing before Committee on Interior and Insular Affairs, United States Senate, February 27 and 28, 1961, Washington, D. C.

Mr. Chairman, Ladies,
and Gentlemen:

I am representing the Puget Sound Section of the Society of American Foresters, of which I am chairman. My name is Jay Gruenfeld. The Society of American Foresters is comprised of professional foresters and has over 13,000 members, approximately three-quarters of the total professional foresters employed in the United States.

The Puget Sound Section of the Society of American Foresters has over 600 members in the State of Washington working for federal, state, and private agencies.

We oppose Senate bill 174 since, in our opinion, it would not promote wise resource management.

In August, 1958, by letter ballot, the Section membership overwhelmingly passed a policy statement that affirmed our belief in the importance and desirability of wilderness preservation. However, it further stated in part:

"The Puget Sound Section of the Society of American Foresters strongly opposes any attempt to establish wilderness areas by blanket legislative action without exhaustive study of individual areas and their inter-relationship with other lands in affected administrative units."

A copy of the entire statement is attached.

Some people believe that foresters are not interested in anything but economics and sawlogs. This is not true.

Most foresters are not only technically trained land managers but are also devout believers in the nondollar values to be found in an out-of-doors career. (Anyone familiar with the forester wage scale knows this *must* be true.) Many foresters, like myself, not only like wilderness but use it.

In our opinion this combination of professional training plus awareness of nondollar values makes the forester unusually well qualified to make objective judgments regarding wilderness.

Thank you for the opportunity of presenting our testimony.

Policy Statement on Wilderness Areas, Puget Sound Section, SAF Adopted August 1958

The Puget Sound Section subscribes to the principle of multiple use of forest and other wild lands; meaning by that, a conscious effort to manage each unit of land for its highest sustained productivity. In some cases, this may mean utilization of an identical area for several purposes at the same time; in others, utilization of different parts of an administrative unit for different single or limited purposes. In all cases, the development of management plans and policies requiries adequate recognition of all resources and benefits, with due consideration of the relative economic and social values of each resource present and of the effects of utilizing one resource upon the stability, value, and appreciation of the others.

Within the framework of these principles, the Puget Sound Section recognizes the importance and desirability

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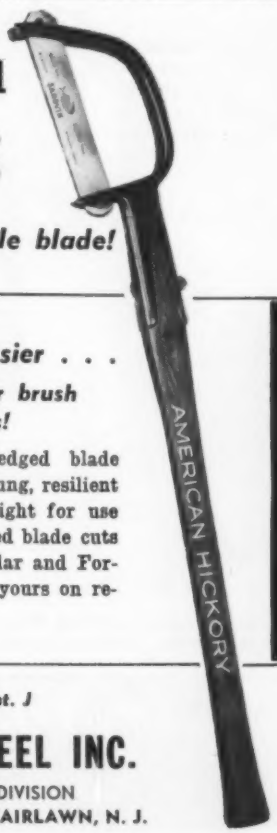

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No pressure—no pre-heating. No explosive fuel. Burns diesel oil, stove oil or mixed fuels with low flash-point.

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for preserving as wilderness those areas most valuable for that purpose so that this and future generations may continue to enjoy those benefits derived only from lands which retain their natural primeval environment. More specifically:

1. Increasing demand by an ever expanding population for a multitude of products and services from forest and other wild lands requires that withdrawals for wilderness use must be correlated with these demands and the total amount of forest and wild land available in each region.

2. Determination of areas considered most valuable for wilderness use must be predicated upon intensive land management studies. Boundaries should be established only by the responsible administrative agencies after careful analysis of all economic, social, and cultural factors tempered by full public discussion.

3. The Puget Sound Section strongly opposes any attempt to establish wilderness areas by blanket legislative action without exhaustive study of individual areas and their inter-relationship with other lands in affected administrative units.

Addition to Consulting Foresters Directory

The following listing should have appeared in the Consulting Foresters Directory published in the January 1961 issue of the JOURNAL OF FORESTRY:

James F. Nicklos, Consulting Forester, 4340 Morpheus Lane, Sacramento 25, California.
Territory: Non-restricted.
Specialization: 4, 10, 15, 16, 17, 18. Special emphasis is placed on forest inventories and valuation.

Division of Forest Management

O. G. Traczewitz was unable to accept the appointment as vice chairman of the Division of Forest Management. As there will be no opportunity for an election before October, Chairman Frank D. Irving has asked John C. Witherspoon, Southern Pulpwood Conservation Association, Atlanta, Ga., to serve as vice chairman for the remainder of this year. Mr. Witherspoon has indicated that he will be available to serve as chairman next year if requested.

Upper Mississippi Valley Section Annual Meeting

The winter meeting of the Upper Mississippi Valley Section was held in the Twin Cities, Minnesota, on February 3-4, 1961.

The technical session on the afternoon of February 3 was held in the Radisson Hotel, Minneapolis. Frank H. Kaufert presided. The topic was "Opportunities for Industrial Development of Timber Resources in Northern Minnesota."

Speakers were James T. Morgan and Arlie W. Toole, Lake States Forest Experiment Station; L. J. Londo, Minnesota and Ontario Paper Company; Robert A. Joba, Northern Pacific Railway; and Richard A. Skok,

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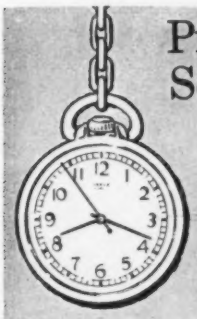

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University of Minnesota School of Forestry.

At the Section's dinner Sidney Weitzman was toastmaster. Henry Clepper discussed the 61st annual meeting to be held in Minneapolis next October 8-11. The principal speaker was Prof. Ronald Brown, University of Minnesota Department of Speech.

Section Chairman Frank Frederickson presided at the business meeting in Green Hall, on the St. Paul Campus, on the morning of February 4.

The annual School of Forestry Foresters' Day of events followed in the afternoon.

The University of Minnesota Forestry Club's award for outstanding achievement was presented to Arnold R. Johnson of International Falls, where he is land commissioner of Koochehing County.

Allegheny Section Holds Winter Meeting in Baltimore

Attending the annual winter meeting of the Allegheny Section held in Baltimore, Md., February 10-11, were some 200 members and guests.

The technical session on the morning of February 10 had as its theme "A Broad Look at the Small Forest Ownership Problem." The keynote speaker was Charles H. Stoddard, Resources for the Future, Inc.

A panel discussion followed, moderated by Ralph C. Wible. Speakers were W. S. Swingler, U. S. Forest Service; Wolfgang Koehler, forestry attaché of the German Embassy; Maurice G. Brooks of West Virginia University; and Kenneth B. Pomeroy of The American Forestry Association.

Three separate sessions were held on the afternoon of February 10.

At the session on forest recreation Hubert D. Burke was leader. Speakers were George R. Kemp of the Allegheny County (Pa.) Department of Regional Parks; Ralph T. Peace, Maryland Department of State Forests and Parks; Sidney Walker, State of New Jersey; and Karl Thompson, Pennsylvania Department of Forests and Waters.

A second panel on watershed activity had as its leader Paul M. Felton. Speakers were Ivan C. Reigner, Northeastern Forest Experiment Station; William E. Sopper, Pennsylvania State University; and Walter C. Sushko, Baltimore Bureau of Water Supply.

A third panel was concerned with small woodlands and private forestry. Roe S. Cochran was leader. Speakers were Robert H. Bommer, Jr., of M. C. Houseworth Lumber Company; William S. Corlett, Pennsylvania Department of Forests and Waters; and John F. Davis, consulting forester.

The Section's dinner was served in the Lord Baltimore Hotel. A. R. Bond was toastmaster. A Baltimore male chorus entertained.

At the business meeting committee reports were made. The following officers were installed:

George R. Moorehead of New Jersey, succeeding Ronald A. Bartoo of Pennsylvania, as chairman.

Paul M. Felton of Pennsylvania ad-

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L to R: Francis W. Sargent, executive director, ORRRC; Senator Gale McGee (Wyo.); Dr. Richard E. McArdle, chief, U. S. Forest Service; and George Vitas, chairman, Washington Section, SAF, at third annual all-day meeting of the Washington Section, at Presidential Arms, Washington, D. C., February 16, 1961.

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vanced from secretary-treasurer to vice chairman.

Henry E. Stasiek, Maryland, elected secretary-treasurer.

Washington Section Discuses Outdoor Recreation

An all-day meeting of the Washington, D. C., Section was held at the Presidential Arms on February 16 with more than 150 members and guests in attendance. Section Chairman George Vitas presided.

During the morning a panel discussed the "Role of Forest Recreation in Forest Land Management," with Section vice chairman Henry F. Wershing serving as moderator. Panel members were Raymond Moody, International Paper Co., Edward P. Cliff, USFS, Thomas L. Kimball, National Wildlife Federation, Edwin T. Scoyen, National Park Service, and Harold G. Wilm, New York Conservation Department.

Brief talks were made during the luncheon by John A. Carver, Jr., Under Secretary of Interior, and by Congressman Harold T. Johnson of California.

During the afternoon session Donald J. Morriss delivered a technical paper on "Timber Management on Recreation Areas," and Francis W. Sargent reported on the work and progress of the Outdoor Recreation Resources Review Commission, of which he is the executive director. Senator Gale McGee (Wyo.), in an interesting and spirited address, underlined the importance of present and future problems facing the nation in the conservation of natural resources with emphasis on water problems.

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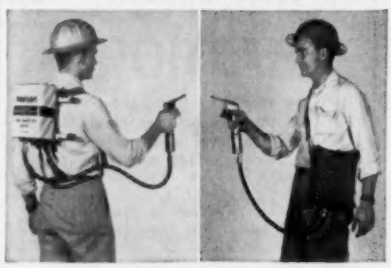

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naughton was present at the meeting, as were past presidents DeWitt Nelson and George L. Drake.

Samuel D. Beichler (1905-1961)

Samuel D. Beichler, veteran of 31 years with the U. S. Forest Service and for seven years head of Cooperative Forest Fire Protection in the Southern Region, died in Atlanta, Ga., February 10, after several weeks' illness. He was 55.

Born in Philadelphia, Pa., August 6, 1905, Mr. Beichler was a graduate of Pennsylvania State University, class of 1929, with a B.S. degree in forestry. He became a full time employee of the Forest Service in 1929. His first assignments were to national forest staff positions in Arkansas and Mississippi. Later he supervised forestry work on an Agriculture Department flood control survey at Cartersville, Ga., and was assigned to national forest land acquisition work. Beichler was associated with forest fire control work in eleven southern states for more than fifteen years and was the Forest Service coordinator for the 10-State Southeastern Forest Fire Compact at the time of his death.

He was a veteran of World War II, and served with the Army in European, African, Asiatic, and Pacific campaigns.

H. William Freed (1916-1960)

H. William Freed, 44, manager of the Timber Division of the Longview Fibre Company in Longview, Wash., died of a heart attack on December 21, 1960.

He was born in Frankfort, Kansas, on June 11, 1916, and graduated from Oregon State College in 1941 with a B.S. degree in logging engineering. He was a member of Xi Sigma Pi, and presided as Forester of the Oregon Chapter during his senior year at college.

Following graduation, Mr. Freed went to work for the Ostrander Timber Company in Oregon. Within a year he was promoted to the position of logging engineer for the company. In this capacity, he had charge of all road location and construction. In 1945, he was hired by Longview Fibre Company as logging engineer. He was subsequently promoted to forest engineer and in 1951 became assistant manager of the timber division. In 1957 he was named manager of the division.

Mr. Freed served in numerous associations and committees relating to forestry and forest management and was president for the year 1960 of the Northwest Oregon Forest Protective Association.

Walter M. Mumma (1890-1961)

Walter Mann Mumma, 70, Republican member of the House of Representatives from the 16th Congressional District of Pennsylvania since 1951, died February 26 in Washington, D. C.

Born in Steelton, Pa., November 20, 1890, he was a 1911 graduate of the Pennsylvania State Forest Academy at Mont Alto. Following five years as forester in the then Pennsylvania Department of Forestry, he became manager of a construction and builders' supply company.

He was elected to the Congress of the United States in November 1950, and served six terms. He was on the Public Works Committee and the Ways and Means Committee.

Mr. Mumma was a member of the Society of American Foresters.

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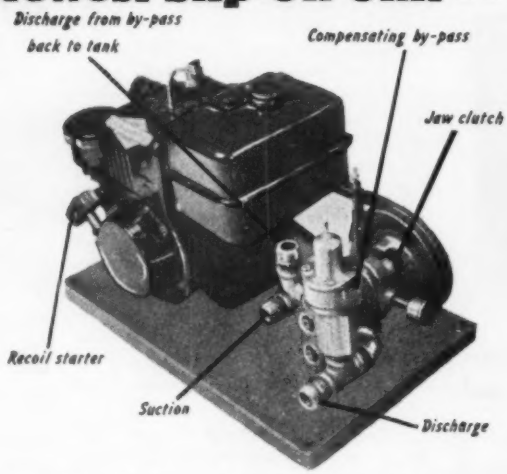

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Membership Applications and Advancements

Proposals for admission, advancement, and reinstatement received in the Society office during the month of February are listed below.

Action on the eligibility of those proposed for membership as listed below will be taken by the Council as of April 30, 1961.

Communications from the voting members regarding the membership eligibility of these persons should be received in the Society office prior to that date.

Allegheny Section

Student Grade

PENNSYLVANIA STATE UNIVERSITY

Beary, L. G.
Fuller, K. B.
Groff, C. H.
Gum, P. W.
Hickok, K. H.
Kocur, M. F.
McIntire, C. O.
Patrizio, J. E.
Waltz, M. J.
Warner, S. F.

WEST VIRGINIA UNIVERSITY

Buckle, B. T.
Koenick, L. J.
Lewis, L. N.
Madore, C. R.
Morris, J. G.
Smallwood, H. A.

Junior Grade

DePietro, G. B., Service Forester, Pa. Dept. of Forests & Waters, Cressona, Pa. Pa. State, BSF, 1959.

Luckenbaugh, G. L., Post Forester, Dept. of the Army, Baltimore, Md. Pa. State, BSF, 1960.

Winning, G. R., Service Forester, Pa. Dept. of Forests & Waters, Warren, Pa. Pa. State, BSF, 1952.

Students Eligible for Automatic Advancement

PENNSYLVANIA STATE UNIVERSITY

Glass, R. N.
O'Hare, J. T.
Pero, R. H.
Perry, P. W.
Peterson, A. M.

WEST VIRGINIA UNIVERSITY

Adams, E. L.
Cones, W. L.
Davis, R.
Foreback, C. G.
Grafton, A. E.
Harman, D. M.
Luzadder, H. R.
Mitten, G. P.
Smith, H. C.
Thayer, J. M.
Vallelonga, J. F.

Appalachian Section

Student Grade

DUKE UNIVERSITY

Fasick, C. A.

Junior Grade

Perry, T. O., Associate Prof., North Carolina State College, Raleigh, N. C. (Affiliate 1957).

Affiliate Grade

Mays, C. G., Area Forester, W. Va. Pulp & Paper Co., Lynchburg, Va.

Traylor, P. W., Ass't. Mgr., Acme Wood Corp., Acme, N. C.

Central Rocky Mountain Section

Student Grade

COLORADO STATE UNIVERSITY

Ehrlich, A. C.
Smith, H. B.
Swartz, R. E.

Columbia River Section

Student Grade

OREGON STATE COLLEGE

Blanchard, G. W.
Cooley, A. R.
Goad, J. A.
Graf, J. F.
Ness, S. P.
Sandstrom, H. P.
Sibley, R. B.
Vroman, K. M.
Wiley, D. D.

Junior Grade

Cadman, W. B., Forester, Crown Zellerbach Corp., Seaside, Ore. (Reinstatement).

Spink, L. R., Forester, USFS, Crescent, Ore. Univ. Idaho, BSF, 1953.

Stephen, G. C., Tbr. Appraiser, County Assessor's Office, Medford, Ore. (Reinstatement).

Tombaugh, L. W., Tbr. Sales Officer, USFS, Carson, Wash. Pa. State, BSF, 1960.

Affiliate Grade

Sabin, G. E., Forester, USFS, Tiller, Ore.

Taipale, R. D., Lt. U. S. Navy, Ewa, Oahu, Hawaii.

Gulf States Section

Student Grade

LOUISIANA STATE UNIVERSITY

Redhead, J. N.

Member Grade

Bloom, R. H., Head Utility Sect., Texas Forest Service, Lufkin, Texas (Junior 1954).

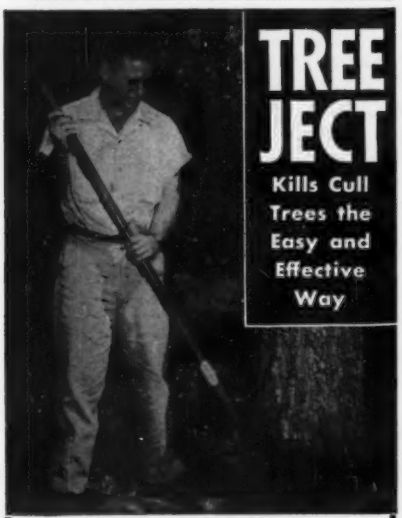
Carey, W. H., Forest Mgr., Bur. of Indian Affairs, Philadelphia, Miss. (Junior 1953).

Craft, H. W., Unit Forester, International Paper Co., Zwolle, La. (Junior 1954).

Mudd, L. S., Consulting Forester, Shreveport, La. (Junior 1954).

Murphy, P. E., Forest Mgr. Farmcraft Associates, Inc., Oakdale, La. (Affiliate 1953 Junior 1954).

Starr, J. W., Associate Prof., Mississippi State Univ., State College, Miss. (Reinstatement).



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Teate, J. L., Ass't. Forester, Mississippi State Univ., State College, Miss. (Junior 1954).

Affiliate Grade

Walker, J. S., Area Forester, Mississippi Forestry Comm., Winona, Miss.

Inland Empire Section

Student Grade

UNIVERSITY OF IDAHO

Burr, B. Middendorf, J. F.
Farmer, E. E. Trojanowski, J. C.
Heck, D. W. Trojanowski, J. W.

Junior Grade

Fisher, J. C., Forester, Nez Perce Nat'l. Forest, Grangeville, Idaho (Affiliate 1959).

Intermountain Section

Junior Grade

Parlat, W. H., Forester, Boise Nat'l. Forest, Boise, Idaho. Mont. State, BSF, 1960.

New England Section

Student Grade

UNIVERSITY OF MASSACHUSETTS

Lane, W. M.

Junior Grade

Jones, R. E., Staff, St. Croix Paper Co., Calais, Maine (Reinstatement).

Students Eligible for Automatic Advancement

UNIVERSITY OF NEW HAMPSHIRE

Allen, J. K. French, C. B.

New York Section

Student Grade

STATE UNIVERSITY OF NEW YORK

Sullivan, A. F.

Junior Grade

Daoust, R. J., 35-53 161st St., Flushing 58, N. Y. State Univ. N. Y., BSF, 1959.

Malkiewicz, R. J., General Foreman, Capital Forestry Co., Inc., Schenectady, N. Y. State Univ. N. Y., BSF, 1950.

Student Eligible for Automatic Advancement

STATE UNIVERSITY OF NEW YORK

McConaughy, D. B.

Northern California Section

Student Grade

UNIVERSITY OF CALIFORNIA

Dierking, E. T.

Junior Grade

Student Eligible for Automatic Advancement

UNIVERSITY OF CALIFORNIA

MacDonald, S. R.

Member Grade

Magill, A. W., Research Forester, Pacific S. W. Expt. Station, Berkeley, Calif. Univ. Wash., BSF, 1957 (Junior 1957).

Northern Rocky Mountain Section

Student Grade

MONTANA STATE UNIVERSITY

Conrad, R. M. Meek, K. A.
Corey, C. D. Noste, N. V.
Glade, L. A. Reesman, L. L.

McMichael, M. D. Roginske, R. F.
Rylander, P. N.

Junior Grade
Students Eligible for Automatic Advancement

Montana State University

Smith, D. L. Witt, R. F.

Associate Grade

Bolles, F. D., Fire Control Officer, USFS, Eureka, Mont.

Ozark Section

Member Grade

Thomas, W. P., Dist. Ass't., Ouachita Nat'l. Forest, Booneville, Ark. (Junior 1954).

Affiliate Grade

Page, B. E., Forester, USFS, Oden, Ark.

Puget Sound Section

Student Grade

University of Washington

Binkley, V. W. Chaney, M. W.
Waali, D. R.

Junior Grade

Finnis, J. M., Forest Specialist, Dept. Natural Resources, Olympia, Wash. Ore. State, MS, 1957.

Affiliate Grade

Metlen, R. W., Dist. Ranger, USFS, Mazama, Wash.

Southeastern Section

Student Grade

Auburn University

Pouncey, R. M.

University of Florida

Marchinton, R. L.

University of Georgia

Davis, J. P. Nix, W. R.
Jordan, H. M. Parker, C. P.

Junior Grade

Drumheller, P. M., 929 Five Mile Rd., Birmingham, Ala. (Reinstatement).

Students Eligible for Automatic Advancement

University of Florida

Brannon, J. D. Rhyne, J. A.

Southern California Section

Junior Grade

Gordon, R. S., Lt., U. S. Army, Sherman Oaks, Calif. Univ. of Calif., BSF, 1961.

Southwestern Section

Junior Grade

Jirsa, D. E., Forester, USFS, Tucson, Ariz. (Reinstatement).

Schmitt, R. M., Asst. Dist. Ranger, USFS, Lakeside, Ariz. Univ. Idaho, BSF, 1946.

Member Grade

Barkman, E. C., Asst. Ranger, Tonto Nat'l. Forest, Payson, Ariz. (Junior 1954).

Crawford, D. W., Dist. Ranger, USFS, Alpine, Ariz. (Junior 1954).

Granfelt, C. E., Range Cons., Ft. Apache Agency, Whiteriver, Ariz. (Junior 1954).

Hardman, E. D., Forester, Region 3, Albuquerque, N. M. (Junior 1954).

Lyngholm, D. H., Forester, Indian Service, Chinle, Ariz. (Junior 1954).

McCune, R. W., Budget Director, S.W. Forest Industries, Phoenix, Ariz. (Junior 1954).

Upper Mississippi Valley Section

Student Grade

Iowa State University

Allen, E. E. Cline, J. P.
Berg, M. D. Corporon, V. R.
Buckner, W. L. Norton, C. L.
Voss, R. L.

University of Minnesota

Cramer, E. W. McCaffrey, K. R.
Johnson, R. L. Skrivseth, B. L.
Klein, J. W. Warren, J. S.
Lytle, G. W. Withrow, R. V.

Member Grade

Allen, M. R., Asst. Forester, Halverson Trees, Inc., Duluth, Minn. (Junior 1954).

Affiliate Grade

Peura, R., Asst. Area Forester, Dept. of Cons., St. Paul, Minn. (Reinstatement).

Wisconsin-Michigan Section

Student Grade

Michigan College of Mining and Technology

Artis, R. G. Flechsig, A. R.
Magnuson, K. C.

Michigan State University

Eckert, G. A. Lawrence, J. L.
Forster, R. B. Proebstle, J. L.
Young, R. A.

Junior Grade

Madison, R. J., Asst. Forester, Upper Peninsula Power Co., Houghton, Mich. Mich. College of Mining & Tech., BSF, 1957.

Peters, J. E., 418 Grant Avenue, Sheboygan, Wis. Yale Univ., BSF, 1956.

Students Eligible for Automatic Advancement

Michigan State University

Adams, W. J. Nigl, R. M.
Brohn, P. D. Plevel, S. R.
Carroll, A. J. Rhodus, G. I.
Clemens, D. L. Schultz, R. P.
Gissibl, R. P. Smith, R. W.
Hendee, J. C. Snowden, W. C.
MacGregor, J. R. Yates, D. M.

No Section

Corresponding Grade

Qui, Le Vinh, Student, Michigan State Univ., East Lansing, Mich.

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Forestry News

American Pulpwood Association 1961 Annual Meeting

The American Pulpwood Association held its 1961 annual meeting at the Hotel Roosevelt, New York City, February 20-23. About 250 attended.

Meetings of the Committees on Forest Management, and Safety and Training were held. Chairmanning the various committees were D. B. Demeritt, Dead River Co., Bangor, Maine, Forest Management; C. S. Herr, Brown Co., Berlin, N. H., Safety and Training; and S. K. Hudson, Container Corp. of America, Brewton, Ala., Technical Programs.

Meetings were held of the legislative committee, chairmanned by K. A. Swenning, Scott Paper Co., Chester, Pa.; the statistics committee, chairmanned by R. C. Barienbrock, The Mead Corporation, Chillicothe, Ohio; and the technical program committee, chairmanned by S. K. Hudson, Container Corp. of America, Brewton, Ala.

The importance and long-range relationships of their woodlands organizations to the pulp and paper industry were discussed by a panel of company executives during the Tuesday, February 21, session.

D. E. Hess, president of the Association (the Glatfelter Pulp Wood Company, Spring Grove, Pa.) was moderator of the four-man panel.

J. R. Kimberly, Kimberly-Clark Corp., Neenah, Wis., discussed the long-range trends of the pulp and paper industry.

T. T. Dunn, Union Bag-Camp Paper Corporation, New York, N. Y., described the type of woodlands organizations which will be required to meet future industry demands.

J. L. Tower, International Paper Co., New York, N. Y., explained the relationship of woodlands organizations to corporate public relations.

J. W. McSwiney, The Mead Corp., Chillicothe, Ohio, pointed out the long-range relationships of pulpwood costs to the rate of return on products produced.

Two sessions related to current developments in pulpwood production, both at home and abroad, featured the February 22nd session.

Paul M. Dunn, St. Regis Paper Co., moderated the panel on "Related Pulpwood Production."

A. W. Greeley, U. S. Forest Service, discussed the withdrawing of commercial forest lands from timber production for other uses.

D. D. Stevenson, Buckeye Cellulose Corp., explained new developments in forest genetics.

T. N. Baker, St. Regis Paper Co., described the present and future potential of pulpwood chip production and utilization as determined from a national survey.

R. R. Edgar, Bowaters Southern Paper Corp., reported on stabilization of pulpwood production.

The afternoon session, chairmanned by A. W. Nelson, Jr., Champion Paper & Fibre Co., discussed pulpwood production, methods, and markets abroad.

C. R. Silversides, Abitibi Power and Paper Co., Ltd., summarized recent developments in Canada.

A. C. Shaw, Champion Paper & Fibre Co., reported on pulpwood harvesting methods in South America.

A. J. Panshin, Michigan State University, showed slides which illustrated new forestry and logging techniques and developments in the U.S.S.R.

R. E. O'Connor, American Paper and Pulp Association, explained the progress which is being made in using various fibres as well as pulpwood in Asia.

Lowell Besley, Pulp and Paper Research Institute of Canada, showed slides which illustrated recent developments in Canadian woodlands research.

At the dinner G. W. Amidon, Minnesota and Ontario Paper Co., International Falls, Minn., was presented an honorary plaque as past president, 1958-1960.

Representatives of pulp and paper companies sponsoring the Southern Pulpwood Production Research Project met to discuss progress. A group of firms interested in the forest prod-

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ucts industry in the southeastern United States has authorized a comprehensive study by Battelle Memorial Institute of wood production in the region.

One purpose of the project will be to study existing methods of producing wood and, by applying modern techniques of research and transportation of forest products from the stump to the consumer, if the information developed suggests usable technological improvements, woodland owners, loggers, dealers, consumers, and the general public stand to benefit. The use of manpower and equipment will be studied in order to determine how these factors influence wood production and transportation to the user. Since weather conditions greatly affect operations of the forest products industry, the effects of weather on men and machines will also be considered in detail.

W. S. Bromley is executive secretary of the American Pulpwood Association.

Private & Industrial

Crown Zellerbach Reports on Hunter Use

Increased hunting activity on Crown Zellerbach Corporation's 13 Washington and Oregon tree farms during the 1960 season was recently reported by the company's Forestry Department.

A total of 25,076 hunters—some 2,000 more than in 1959—bagged 3,726 big game animals on Crown Zellerbach lands. These included 2,939 deer, 613 elk, 134 bear, 19 bobcats, and 21 coyotes. The deer count was up 871 over 1959, while 17 less elk were taken. Bear kill figures increased by 63 animals, 37 of them taken by paid trappers.

All tree farm units were open to hunters and fishermen during 1960 but some areas, where logging operations were under way, were closed during the work week. Because of extreme fire hazard some lands were closed for several days at the beginning of the deer season.

According to George H. Schroeder, Crown Zellerbach chief forester, there was little vandalism, and fire loss due to untended hunters' fires was low.

Joins Industrial Forest Association Staff

Joseph G. Wheat has been appointed forester on the staff of the Industrial Forestry Association at Nisqually, Wash., according to W. D. Hagenstein, executive vice president. He will work under the supervision of Dr. J. W. Duffield, technical director of the Association's forest tree improvement program.

Wheat, who served with the Coast Artillery during World War II, was graduated from the College of Forestry, Iowa State University, in 1949. He received a Master degree in plant breeding in 1955 from the same school. For the past ten years he has been on the staff of Iowa State University specializing in plant breeding.

Wheat is helping establish Association seed orchards for growing improved seed for the Association's forest nursery, and will check results of seedlings grown from improved seed in the field.

Public

Florida Nursery Dedicated to First State Forester

The Florida Board of Forestry dedicated what was formerly known as its Olustee Nursery to the memory of Florida's first state forester, Harry Lee Baker, on December 7, 1960.

Mrs. Harry Lee Baker, Sr., widow of the Florida Forest Service's first administrative head, unveiled a bronze plaque renaming the nursery the "Harry Lee Baker Memorial Nursery." Simultaneously with the unveiling of the plaque, a highway sign which identifies the nursery was also unveiled.

Harry Lee Baker, Jr., and Harry

Harry Lee Baker, Jr., and his mother Mrs. Harry Lee Baker, Sr., shown by the plaque which dedicates the Harry Lee Baker Memorial Nursery at Olustee, Florida.

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Lee Baker III planted a seedling as a living memorial beside the boulder on which the plaque is mounted.

Baker was Florida's first state forester, and served from 1928 until 1940. Both the Florida Board of Forestry and the Florida Forest Service were established by the State Legislature in 1927.

Henry J. Malsberger, general manager of the Southern Pulpwood Conservation Association, presided over the dedication ceremony. Malsberger was Florida's second state forester.

C. Huxley Coulter, Florida's third and present state forester, delivered a brief address and introduced honored guests.

Director of Interior's Technical Review Staff Selected

Charles H. Stoddard has been named to head the department's Technical Review Staff, Secretary of the Interior Stewart L. Udall announced in February. Composed of specialists in the resource conservation fields, the staff provides advisory and staff coordination services to the Secretary and the Secretariat on program and policy matters.

Prior to his appointment, Stoddard was for five years a resource economist with Resources for the Future, Inc. He succeeds John B. Bennett who had been director of the Technical Review Staff since May 1957.

Stoddard received a B.S. in forestry in 1935 and a M.S. in forest economics in 1938, both from the University of Michigan. He did further graduate study at the University of Wisconsin and at Princeton University. He served as a forest economist with the U. S. Forest Service from 1936 to 1940, and as an economist with the Bureau of Agricultural Economics from 1941 to 1943. Following World War II, during which he served as a lieutenant in the Navy, Stoddard was awarded the Charles Lathrop Pack Forestry Foundation Research fellowship.

From 1953 to 1955 Stoddard was consultant to the Legislative Forestry Study Commission in Minnesota. He has served as consultant to the Senate Small Business Committee, member of the Task Force for Distressed Areas, consultant to the Wisconsin Department of Resource Development, and the New Hampshire Planning and Development Commission.

New York Survey of Salaries Points Up Inequities

At the request of New York's Governor Nelson A. Rockefeller an objective, independent, and professional comparison of state salaries with those paid by private industry has been completed. This survey was conducted by McKinsey & Company, Inc., Management Consultants of New York City.

Of particular interest to New York foresters, the survey shows that beginning professional salaries paid in private employment are at least 20 percent higher than in the state service. In the intermediate professional positions (Grades 16-25) it was found that cash compensation of individuals in analogous positions in private employment averages 27 percent above state salaries. The disparity in compensation was found to be even greater at the higher professional levels. Private salaries averaged 34 percent above state salaries at the assistant commissioner level.

The survey points up the fact that public and private employers' experience reveals that beginning professional workers, i.e., chemists, biologists, engineers (and foresters), who are perhaps the most sought after type of employee by the state at this time, can be recruited only if the state offers cash compensation substantially equivalent to that offered by other employers. Once employed, cash compensation must remain nearly equivalent to obtain employees in professional positions.

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Beattie Heads USFS Watershed Work

Byron Beattie, assistant regional forester in charge of the Division of Resource Management, Eastern Region, U. S. Forest Service, Upper Darby, Pa., has been promoted to director of the Division of Watershed Management at national headquarters, Washington, D. C. He replaces Gordon R. Salmond, who recently retired after nearly 40 years of government service.

A native of California, Mr. Beattie graduated from the University of California's College of Forestry in 1935 and immediately accepted a position with the U. S. Forest Service. Serving in positions of increasing importance on California national forests from 1948 to 1954, he was advanced to the position of supervisor of the Sierra National Forest. In 1954 he transferred to Washington, D. C., and served for two years as assistant director in the Division of Fire Control. Since 1956, he has been assistant regional forester of the Eastern Region with headquarters at Upper Darby, Pa.

Thomas W. McKinley Retires

Thomas W. McKinley recently retired at age 70 after more than 30 years of federal service. At the time he was forest adviser to Haiti with the International Cooperation Administration. Mr. McKinley has been in active forestry work since 1915, a member of the SAF since 1919.

After graduation from Ohio State University in 1915 with a B.S. in forestry McKinley immediately went to work with the Indian Service and remained with it until 1921, exclusive of 14 months in the Army in World War I. He transferred to the General Land Office in 1921 and then entered the U. S. Forest Service in 1925, serving in Idaho and Virginia. From 1930 to 1936 he managed a privately owned forest in Kentucky, returning to the Forest Service in its Southern Region in 1937, following a short period with the Agricultural Adjustment Administration. In 1942 he went with the Board of Economic Warfare and worked for two years in Ecuador in balsa wood production. Additional federal service has included the War Production Board, the Bureau of the Census, and the Office of Price Stabilization. He joined ICA in 1953, working in Viet Nam, Hawaii, and most recently in Haiti.

Mr. McKinley is making his home in Clearwater, Fla.

Charles P. Mead Retires

Charles P. Mead, assistant director of technical programs, Bureau of Land Management, Department of the Interior, retired effective February 4, 1961, with 27 years of federal service. He plans to engage in consulting work in the land management field.

Mead, a native of New York State and a 1932 graduate of the Department of Forestry, Cornell University, joined the U. S. Forest Service in 1933. From 1935 to 1941 he served as district forest ranger on the George Washington National Forest, Virginia. Prior to entering the Army Air Corps in 1942 Mead was a district ranger on the White Mountain National Forest, New Hampshire. Upon separation from the armed forces, he returned to the George Washington National Forest as a staff assistant.

In 1948 he took leave of absence and returned to Cornell to engage in graduate study, receiving a Master degree in public administration in 1950. In July 1950 he transferred from the Forest Service to the Bureau of Animal Industry, Department of Agriculture, as chief of Section, Employee Training, Relations and Safety. In October 1952 he transferred to the Bureau of Land Management to accept a district manager's position in Russellville, Ark. In 1954 he was transferred and promoted to the Eastern States Office in Washington, D. C., where he was chief of Land Classification and Forestry. In September 1956 Mead was appointed assistant director in charge of the technical activities of Lands, Minerals, Range, Forestry, Cadastral Engineering and International Cooperation. In this position he coordinated these activities for Director Edward Woozley.

Schools

Yale Institutes New Program in Forest Pathology

The Yale School of Forestry announces an expansion in its program of graduate instruction and research in forest pathology. Training offered at the doctoral level will have greater emphasis on physiological and biochemical aspects of forest disease and wood products deterioration problems than heretofore has been available in the United States. At the same time, the conventional program in the descriptive phases of the subject will be maintained, especially at the Master level. To initiate this new program, the School has appointed Dr. Ellis B. Cowling as assistant professor of forest pathology, to succeed Dr. J. S. Boyce who retired as professor emeritus in 1958. Facilities for instruction and research in physiological as well as descriptive aspects of forest pathology are being installed in the School's new Greeley Memorial Laboratory. Nearly 10,000 acres of School forests are available for field work in three different forest types in New England.

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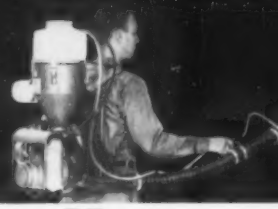

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The program will be administered by the School of Forestry, in cooperation with the Departments of Botany, Microbiology, and Biochemistry at Yale University, the Connecticut Agricultural Experiment Station, and the Forest Insect and Disease Laboratory of the Northeastern Forest Experiment Station, U. S. Forest Service.

Dr. Cowling holds B.S. and M.S. degrees from the State University of New York College of Forestry at Syracuse University, a Ph.D. in plant pathology and biochemistry from the University of Wisconsin, and a "Filosofie Licensiat" degree in physiological botany from the University of Uppsala, Sweden. His experience includes a three-year appointment as pathologist at the U. S. Forest Products Laboratory at Madison, Wis., and one year as a U. S. Public Health Service postdoctoral fellow at the University of Stockholm and the Biochemical Institute of the University of Uppsala.

Cornell Program in Natural Resources Conservation

Cornell University is now offering "Natural Resources Conservation" as an area of concentration for graduate study. An interdisciplinary program in resources development may be built by the appropriate selection of major and minor subjects. This program is only open to those who already have professional training in one of the specialized fields concerned with natural resources management (forestry, fisheries or wildlife management, hydrology, agronomy, soil conservation, etc.), or to those trained professionally in some of the social sciences (economics, public administration, etc.) who are now concerned with natural resources development. In either case, professional job experience is required. The program is especially oriented toward natural resource managers who are moving into higher echelons of policymaking. Some possible major or minor subjects in addition to this one are: agricultural policy and economic development, the administrative process, regional planning, public administration, soil and water engineering, soils, fishery biology, wildlife management, forest conservation, aerial photographic studies, land economics.

A new interdisciplinary seminar has been instituted as an integrating core for this program. Last year the seminar focused on water resources and produced a proposal for resources development in a specific watershed in New York. This year the focus is on "The Determinants of Land Use." The program is centered in the Department of Conservation. Contact Professor Lawrence S. Hamilton, Fernow Hall, Cornell University, Ithaca, N. Y. for further information.

Iowa Professor on Assignment in Indonesia

Prof. Dwight W. Bensend of the Iowa State University Department of Forestry recently left for the University of Indonesia, Bogor, Java, where he is employed by the University of Kentucky under an I.C.A. contract. Prof. Bensend will teach courses in wood technology, forest products, and logging and advise on the selection of equipment and the development of a forestry curriculum. The University is building a new College of Agriculture and the first buildings to be erected will house the forestry school.

Prof. Bensend's leave of absence from Iowa State University will extend through October 1962.

Wood Technologist Joins Missouri Forestry Staff

James P. Pastoret has been appointed assistant professor on the staff of the University of Missouri School of Forestry, R. H. Westveld, director of the School, has announced.

Pastoret will devote one-half his time to research in wood technology. In addition, he will teach courses in wood technology, timber seasoning and preservation, and wood deterioration.

A native of North Dakota, the new staff member earned B.S. and M.S. degrees in wood technology at the University of Michigan. For the past two years he has been working on his Ph.D. degree at North Carolina State College. He plans to complete this work soon.

Pastoret fills the staff position formerly held by Lawrence Leney who resigned to join the staff of the College of Forestry, University of Washington, Seattle.

N. Y. College to Mark 50th Anniversary

The fiftieth anniversary of the State University College of Forestry at Syracuse University, Syracuse, N. Y., will be celebrated April 12-14, 1961. An extensive program of social and scholastic events as well as general and technical sessions are planned for alumni and visitors.

Allied

Southern Pulpwood Conservation Association Officers Elected

J. E. McCaffrey, vice president of International Paper Company, Mobile, Ala., was elected president of the Southern Pulpwood Conservation Association for 1961, at the organization's annual meeting, held February 7-8 at the Roosevelt Hotel in New Orleans, La. Nearly 500 delegates from 12 southern states were in attendance.

W. J. Bridges, Jr., of Savannah, Ga., director of woodlands for Union Bag-Camp Paper Corporation, was elected vice president of the association.

The pulpwood group also selected a 13-member board of directors group

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to serve with Mr. McCaffrey and Mr. Bridges during the current year.

Mr. McCaffrey, who has more than 40 years' forestry experience in the United States, Canada, the Balkans, Central America, and the Philippines, was an organizing member of the Fifth World Forestry Congress. He is currently a member of the Advisory Council to the President's Outdoor Recreation Resources Review Commission. He has been, or is now, an officer or director of numerous forestry organizations in the United States, including the American Pulpwood Association, American Forest Products Industries, Inc., and The American Forestry Association.

Mr. Bridges, a native of Norfolk, Va., is a director and a member of the executive committee of the American Pulpwood Association and served as chairman of the finance committee of SPCA in 1960. A former woods manager for Hollingsworth and Whitney Company, in Mobile, Ala., and International Paper Company, in Georgetown, S. C., he joined Union Bag-Camp Paper Corporation eight years ago. He is also currently serving as director of the Forest Farmers Association.

Redwood Region Conservation Council Elects Officers

Roy G. Wagner, Masonite Corp., Ukiah, was elected president of the Redwood Region Conservation Council at the annual meeting held in Eureka, Calif., January 27, 1961.

Officers elected with him by the group included: Alfred H. Merrill, Georgia-Pacific, Samoa, vice president; Lowell J. Chapman, Arcata Redwood Company, Arcata, treasurer; and Walker B. Tilley, Redwood Valley, secretary-manager.

Elected for three-year terms were three new members to the RRCC board of directors, including: Larry T. Marshall, U. S. Plywood Corp., Arcata; Bernard Agrons, Rockport Redwood Co., Rockport; and R. R. Chaffee, Berkeley.

Virginia Forests, Inc., Holds Eighteenth Annual Meeting

The eighteenth annual meeting of Virginia Forests, Inc., the state forestry association of Virginia, was held in Richmond on February 1 with an attendance of 160 members and guests.

At the business meeting a report on the association's progress and activities was given by William E. Cooper, executive director. Henry Clepper, SAF executive secretary, was the luncheon speaker.

A program devoted to "Wilderness Areas—Their Place in Virginia" featured M. M. Sutherland, Virginia Department of Conservation and Economic Development; A. H. Anderson of the George Washington National Forest; Col. J. D. Snow of the U. S. Corps of Engineers; and H. S. James of Union Bag-Camp Paper Corporation.

George W. Dean, state forester, gave a report on the work of the Division of Forestry.

At the association's annual dinner, I. T. Haig of Asheville, N. C., gave an illustrated talk on "Developments in World Forestry."

The annual award "Man of the Year in Forestry" went to Joseph Coleman Hayes of Cumberland, a forester with the Virginia Division of Forestry.

Forestry Employment

S.A.F. members are privileged to insert one 60-word advertisement in this column without charge. Forest industries desiring to employ foresters may insert advertisements at the rate of $4 per column inch. Copy must be received by the end of this month for an advertisement to appear in the issue after next.

Obviously the Society cannot assume responsibility beyond making it possible for prospective employee and employer to enter into negotiations.

Position Available

Wood utilization specialist for resource development project in eastern Kentucky. Master's degree, or bachelor's degree plus experience, in wood utilization required. Experience should include wood using industries, sawmilling, and logging. Salary dependent on education and experience, but quite adequate. Position includes fringe benefits, government civil service insurance and retirement privileges.
Apply to Prof. O. M. Davenport, Forestry Section, Agricultural Experiment Station, University of Kentucky, Lexington, Ky.

Positions Wanted

Position in logging or management desired. Western states or foreign. Forestry graduate, 31, married. Western and Alaskan experience include most phases public land management, private engineering, logging, consulting. Private pilot. Presently in private recreation.
Box F, Society of American Foresters, 425 Mills Building, Washington 6, D. C.

Professional forester with 10 years experience. B.S.F. Penn State University 1950. Five years with State Conservation Department—forest inventory, farm forestry, and county forest management. Private consulting forestry; tree planting, timber cruising, timber stand improvement and management. Real estate appraiser; timber and land evaluation. Desire position commensurate with experience and opportunity for advancement. Northeast preferred.
Box G, Society of American Foresters, 425 Mills Building, Washington 6, D. C.

Forester, B.S.F. 1957: Wants position with responsibility and advancement with professional organization. Information on request.
Box H, Society of American Foresters, 425 Mills Bldg., Washington 6, D. C.

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Conway Contracting Co., Conway, S.C., produced an average of 75 cords of pulp per week with two T-340's when other crews were mud-bound. The T-340 has pull-power to skid better than three tons per trip.

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Its many new features give you greater dependability, too. New powdered steel clutch spider is stronger, lasts longer. New Plastisol ends completely seal the air filter. Long flange chain guide plates feed the chain smoothly into the bar groove, extend the life of both chain and bar. And a new fuel cap relief valve assures you of positive venting at all times.

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